THE

ELECTRICAL REVIEW.

VOL. LXIII. AUGUST 28, 1908. No. 1,605.

ELECTRICAL REVIEW.

Vol. LXIII.] CONTENTS: August 28, 1908. [No. 1,605.

	Page
British Trade with Russia...	321
Cylinder Condensation	322
British Association Meeting	323
The "Merz-Price" System of Automatic Protection for High-Tension Circuits (*illus.*)	324
Notes on Pushing Business (*illus.*)	328
Correspondence:—	
Defective Hand Lamps (*illus.*)	329
The Cause of a Fire	329
Metal Filament Lamps	330
Rail Corrugation	330
The Electrical Industry	330
Rapid Preliminary Calculation of Illumination	331
The Purchase of Coal on a Scientific Basis	332
The Use of Meters on Tramcars	333
Forms for the Use of Electrical Undertakers	333
New Electrical Devices, Fittings, and Plant (*illus.*)	335
Business Notes	335
Electricity in the "Premier" Mill (*illus.*)	339
Colliery Cable Practice	341
An Electrical Smelting Furnace for Steel (*illus.*)	342
Notes	347
City Notes	349
Electric Tramway and Railway Traffic Returns	350
Stocks and Shares	350
Share List of Electrical Companies	351
Exports and Imports of Electrical Goods during July, 1908	353
Some Notes on Steel Constructional Work for Central Stations (*illus.*)	354
Contracts with Local Authorities	356
Notes on Electricity Supply—For the Young	356
Tangled Topics	357
An Accumulator-Driven Shunting Locomotive (*illus.*) ...	358
Automatic Elevators	358
The Junior Institution of Engineers	359
New Patents Applied For, 1908	360
Published Specifications	360

THE ELECTRICAL REVIEW.

Published every FRIDAY Price 4d.

The Oldest Weekly Electrical Paper. Established 1872.

TO BE OBTAINED BY ORDER FROM ANY NEWSAGENT IN TOWN OR COUNTRY.

OFFICE:—4, LUDGATE HILL, LONDON, E.C.

Telegraphic Address: "AGNEKAY, LONDON." Code, A B C.

Telephone Nos. Holborn 933 Central 4425 (Editorial only).

ALL Letters should be addressed to the Proprietors, H. Alabaster, Gatehouse & Co

ADVERTISEMENT RATES ON APPLICATION.

The "Electrical Review" is the recognised medium of the Electrical Trades, and has

BY FAR THE LARGEST CIRCULATION

of any Electrical Industrial Paper in Great Britain.

SUBSCRIPTION RATES.—Per annum, postage inclusive, in Great Britain, 19s. 6d., Canada, £1 1s. 8d. ($5.30). To all other countries, £1 10s.

BINDING.—Subscribers' numbers bound, including case, for 4s. each volume.

CASES.—Cloth Cases for Binding can be had, price 2s. 6d. each; post free 2s. 9d.

READING CASES, to hold from One to Twenty-six Numbers until the volume is complete for Binding, can be had from the Publishers, Price 6s., or Free by Post (in Great Britain), 6s. 6d.

FOREIGN AGENTS.—New York: D. VAN NOSTRAND, 23, Murray Street. TORONTO, ONT.: WM. DAWSON & SONS, LTD., Manning Chambers. Paris: BOYVEAU & CHEVILLET, 22, Rue de la Banque. Berlin: ASHER & Co., Unter den Linden.

Cheques and Postal Orders (on Chief Office, London), to be made payable to MR. H. ALABASTER, 4, Ludgate Hill, E.C.

THE

UNIVERSAL ELECTRICAL DIRECTORY

(J. A. BERLY'S).

1908 EDITION

H. ALABASTER, GATEHOUSE & CO.,

4, Ludgate Hill, London, E.C.

BRITISH TRADE WITH RUSSIA.

WHEN we have stated in these columns that British electrical business with foreign countries might be considerably increased if we were a little more in earnest in our pursuit of that class of trade, we have not written without knowledge. If we are prepared to devote sufficient effort and money in that direction, we shall find our investment to be one yielding a good return before very long. We are led to make these remarks again this week by the announcements concerning the visit to this country of a deputation from the Warsaw Chamber of Commerce, whose object, as announced in a daily paper, is to induce English manufacturers to boom their manufactures in Russia and Poland. In those two countries there is reported to be a boycott of German goods, and merchants who have been in the habit of obtaining many millions of pounds worth of manufactures from Germany every year, desire that that portion of those goods which was obtained from England for trans-shipment to Russia and Poland, should in future be supplied direct from this country instead of passing through German hands. If this be not done it is easy to see that the boycott of Germany may mean the shutting out of a good deal of British trade, so that we shall be the sufferer. If it is done English manufacturers can either secure a larger margin of profit or give the purchaser better terms than it was possible for him to secure when the German profit was added. In an interview with the *Daily Express*, M. Welt, a prominent chemical manufacturer of Warsaw, who is a delegate from the Chamber of Commerce of that city, has stated that, if English business men will only realise it, they have an excellent opportunity of building up a big trade with Russia. He also says, what has been stated many times before in regard to other markets, but without our appreciating its significance, or, at any rate, without our acting upon that appreciation if we have it, that German goods have not been bought in this particular market because they were German goods (as we have pointed out much has actually been British material sold by Germans), but because they were the only goods offered, German commercial travellers with a knowledge of the language having devoted themselves to an energetic exploitation of all parts of Russia. British remissness in regard to direct cultivation of the market is pointed out by M. Welt—we send few travellers, and those few cannot speak the language.

Among the various classes of manufactures required, the delegate names as one, "Machinery of all kinds," and we presume that that includes electrical. We do not know to what extent German importers have taken British electrical manufactures into these parts for us—we do not think they can have done anything very considerable in that way; but the importance of the present situation lies in the fact that British electrical manufactures would

be preferred there in competition with those of Germany, which we have always understood had a good hold upon the Russian electrical market. If what we read is correct it is reasonable to deduce that Germany has obtained a market for electrical materials in Russia largely because her travellers have pushed them there; merits in such matters as design, efficiency, and price, have been quite secondary considerations.

According to the *Evening Standard*, the Russian deputation drawn from all parts of the country, and numbering between 40 and 50 influential commercial men, will arrive here on September 4th and remain until the 8th. The London Chamber of Commerce is setting apart rooms for the convenience of the visitors, and a meeting was called for Wednesday last to discuss arrangements. It seems to us that this ought to afford the Electrical Section of the Chamber an opportunity of doing some good to British electrical industry. So far as we are aware, the performances of that section have not in recent years been overwhelmingly valuable. Can it do something to enlighten our Russian visitors concerning the electrical manufacturing abilities of the United Kingdom?

We are not losers by our having sold to Germany for resale to Russia or any other country, any more than we can describe Germany as a loser when we buy from her, as we do pretty largely for trans-shipment to our Colonies and other markets. But we might have supplied British goods to the consumer more cheaply without the intervention of the German importer and thus have created a market for larger quantities, and maintained a firmer hold upon the commerce of the country, in which case there would have been no fear of the present boycott affecting our exports. Our old reputation of being a nation of shopkeepers, given to us by Napoleon, wants a little looking to, very enviable as it is to be the manufacturing country from which other commercial nations can purchase.

Is it a fact that our curriculum for the training of men for the business of travellers ignores Russian as a commercial language, or have our manufacturers so far under-estimated the value of a man who can boast of that acquisition? If the Russian language is the chief drawback to our trade expansion in that country, the sooner a dozen or more British electrical engineer travellers devote themselves to a study of that tongue the better will it be for our works which are requiring markets where they can place their present surplus output. It is a commonplace to say that the potentialities of Russia are enormous, and in the interests of both the present and the future, we should endeavour to sail in while wind and tide are in our favour.

We ought not to shut our eyes to the great possibilities of electrical development in European countries—Russia, Turkey, Spain—all these and some others must require electrical assistance from outside sources. Why not from England? Our national relations with all are now on a far more satisfactory basis than they have been for years past—why should we not grasp the opportunities? Why should not all these electrical factories in England which are stated to be crying out for profitable work, be occupied with this seaborne trade to which we made a reference in our last issue? A Consul in Spain advises us to make a thorough study of the electrical possibilities of Spain; the Russians wonder why we do not send to put our wares before them as the Germans do; Turkey is opening its doors to more modern civilisation which must carry with it great electrical requirements. Surely near home we have important possibilities! These are times when a lethargic unconcern in trade is followed by the nemesis of failure, for truly it has its reward.

CYLINDER CONDENSATION.

A SERIES of articles has recently appeared in the *Engineer* on the subject of cylinder condensation. Our contemporary is never so happy as when making a mystery of what happens in a steam engine. At present, apparently taking its cue from the propositions on which the new school of leakage theorists attempt to found arguments subversive of Hirn's theory, the *Engineer* seems to acquiesce in the claim that the ratio of condensation and evaporation in a cylinder are greater than can be proved possible. But the new theory of leakage is by no means accepted, and so there is nothing left but leakage or the old theory, for no new theory is put forward. Now leakage is certainly not the cause of the missing quantity unless we are to accept leakage in both directions in a too curious sequence to be considered, for while steam is certainly missing at one time much of it reappears exactly as it should do by Hirn's accepted condensation theory. It is brought forward as an argument against this theory that condensation cannot occur in the cylinder in the brief space of time that is allotted to it during the period of admission, and the strange argument in support of this claim is that the rate of condensation in a surface condenser is by no means so rapid, for if a water chilled surface only condenses 10 lb. per hour per sq. ft., why should a cylinder condense so very much more? This argument seems to us very unconvincing. Any engineer who has before him a condenser with a pressure gauge upon it knows that the fluctuation of the needle of the gauge is very small. Yet the interior of the condenser is, from time to time, put into communication with the cylinder, in which is steam at half or three-fourths of an atmosphere. If it is correct to allow that a condenser has only condensing power of 10 lb. per sq. ft. per hour, would it not be found that the finger of the pressure gauge showed a considerable rise of pressure every time the exhaust valve opened? Yet even with large slowly rotating engines this does not occur. The steam falls to condenser pressure almost instantaneously, and during the remainder of the exhaust stroke the circulating water is absorbing the heat that has been put into the tube surface. This tube surface acts instantaneously, and would continue to act as rapidly with a thousand times as much steam, if the tube metal could carry off the heat and pass it into the water. The conductive power of the tube metal measures the mean capacity of the condenser to destroy steam, but it is no measure of the capacity of the tube surface, which, if one may employ a negative idea, is slowly accumulating cold by conduction from within, and in very much more time than serves for it to absorb heat externally from wet steam.

The condenser is, in short, always working at, or near, constant temperature, and must, therefore, work solely by internal effects. Its surfaces are never cooled by giving up heat, to dew upon them, for the formation of steam.

In a cylinder all this is changed. Very little heat is lost by conduction through the thickness of the cylinder; but the pressure is constantly changing. At one time it is low—that of the condenser—and dew upon the cylinder walls will absorb heat from those walls with enormous rapidity. This is no mystery, for will not any surface above evaporation temperature flash steam instantly, with a hiss,

from a rapidly touched wet rag or a moist finger? The surface will be cooled by this action, and will as rapidly condense a corresponding portion of fresh steam. The amount of steam thus almost instantaneously condensed may be 20 or 30 per cent. of each charge of steam, but the actual amount condensed at each application to the cooled surface is not great; and if a calculation could be made of the weights condensed, and the time during which condensation continues, it is probable that with every condition fairly allowed, the cylinder effect would not appear more mysteriously rapid than that of the surface condenser.

The mistake has been made of taking the mean hourly rate as representative of the true rate of surface efficiency, whereas it is only a measure of the conductivity of the tube metal or of the absorptive power of the water. Indeed, if the claims made for Row tube effects and turbulent flow be true, and there seems good reason to allow such claims, the mean efficiency of a surface condenser is rather that of the power of the water to gather heat from the tubes, than of the tube metal to carry heat between its two surfaces. But it is at least certain that cylinder metal effects are entirely another matter, and that condensation is a rapid action wherever there is a cold surface. It is equally certain that this rapid action cannot be prolonged; it is also true that the condensing action ceases when there has been no previous cooling by re-evaporation. Condensation is also diminished by lubrication, and this is perhaps to be explained by the same reasoning which would explain why a boiler-heating surface will become overheated by the merest film of oil on its water side. Oil evidently causes serious delay in heat transmission between metal and water, and would therefore act so as to prevent re-evaporation in a cylinder, and the water would pass out as water and not as steam. There seems, in short, to be very little reason to presume any mystery in respect of the accepted cylinder condensation and re-evaporative effects, or to doubt the accuracy of Regnault's figures as to the physical properties of steam. So much has been argued of late on the basis of the mean rate of action of a surface condenser, that it has been overlooked that condensers are calculated to perform rapid condensation at intervals, and the allowance of 10 lb. more or less per square foot of surface, is merely an empirical method of stating an area that will in practice serve to maintain a condenser pressure at a uniformly low figure. Very much less surface will perform the duty of condensation, as witness the jet condenser, but the minimum surface allowance depends upon conduction entirely. Given conduction there will always be enough surface. In a cylinder conduction plays a very small part.

British Association Meeting.

For the fourth time since its foundation the British Association for the Advancement of Science is about to hold its annual gathering in the city of Dublin. On Wednesday next, September 2nd, the President, Mr. Francis Darwin, F.R.S., will deliver his address, which will not be over-absorbing to electrical men *as* electrical men—however interesting it may be to them as men of scientific thought—judging from the Press forecasts, and having regard to the specialised study which the author has devoted to one particular department of scientific research.

Nor does the advance programme of the Engineering Section indicate great electrical possibilities there, though there are many matters that are of concern to electrical engineers. The chairman of the Section is Mr. Dugald Clerk, F.R.S., to whom Section G. was greatly indebted last year for the leading part taken by him in various papers and discussions relating to gas engine subjects. Thursday next will be devoted solely to the delivery of his Sectional address, the theme of which will be "The Laws of Thermodynamics as Applied to Heat Engines and Considered in Relation to the Work of Lord Kelvin," and Friday will be occupied with a joint discussion with Sections A and B of the report of the Committee on Gaseous Explosions. On later days the following subjects, among others, will be brought forward:—

Monday, September 7th.—Gerald Stoney, M.Inst.C.E.—"Recent Advances in Steam Turbines."
P. Emerson Dowson, M.Inst.C.E.—"Producer Gas."
P. W. Robson.—"Suction Gas Producers."
Captain H. Riall Sankey, R.A., M.Inst.C.E.—"The Utilisation of Peat for making Gas or Charcoal."
Tuesday, September 8th.—F. W. Lancaster.—"The Laws of Flight."
F. H. Royce, M.I.Mech.E.—"The Causes of Wear in Motor Vehicle Machinery."
W. Worby Beaumont, M.Inst.C.E.—"On a Fundamental Error in the Theory of Power Transmission by Belts."

Other papers to be read in the Engineering Section include one by Mr. F. Douglas Fox on "Railless Traction," a subject which is now again occupying the attention of a number of towns in the provinces and in Scotland, and one by Mr. W. Rosenhain on "The Study of Breakages."

In Section A (Mathematics and Physical Science) the address of the chairman, Dr. W. N. Shaw, will discuss "The Relation of Government Institutions to the Advancement of Science"; while in B (Chemistry) we shall hear from Dr. F. S. Kipping of "The Decadence of Chemical Industries in the United Kingdom, and the Means to be adopted for their Reinstatement." The contributions that are to be submitted in "A" include the following:—Mr. A. P. Trotter, "The Position of the Mercury Ohm in British Legislation"; Sir O. Lodge and Mr. B. Davies on "The Measurement of Large Inductances containing Iron"; Mr. G. A. Hemsalech on "New Methods of Obtaining the Spectra of Flames"; Sir Wm. Ramsay on "Do the Radio-Active Gases (Emanations) belong to the Argon Series?" Mr. T. Royds on "Further Experiments on the Constitution of the Electric Spark"; Dr. J. W. Nicholson on "The Self-Inductance of Two Parallel Wires." Sir Oliver Lodge, who always meets with a very cordial reception whenever he rises to his feet to address the members of the British Association, whether in sectional or other gatherings, is, according to report, to contribute something on "Electricity in the Stimulation of Crops." It will be remembered that some notes by Sir Oliver on his recent experimental study of this subject appeared in the ELECTRICAL REVIEW a few weeks ago.

Dissimilar as must be the matters to be dealt with in all the different sectional addresses, there will be one respect in which these, together with the address of President Darwin, will be in sad accord. Last year at the Leicester meeting, when some of the sections met to jointly discuss "The Constitution of the Atom," the presence of Lord Kelvin upon the platform, together with Sir Oliver Lodge, Sir Wm. Ramsay, and Profs. Larmor, Rutherford and Soddy, and his characteristically spirited and courteous contribution to the controversy concerning "electrions," will fix the occasion and the scene indelibly upon the minds of those who cherish his lordship's memory. Since then science has been bereft of its leader, and those who assemble at Dublin this year will deeply recognise the loss under which all suffer. The voice that is still will be missed beyond expression. The veteran, slightly limping, greatly loved, with his half-closed, dreamy, far-off looking eyes, will be missed from his accustomed place upon the platform, but his labours will continue to be strongly in evidence in the proceedings of the Association in years yet to come. The services of his late lordship will be reverently and eloquently applauded by president and sub-presidents alike, and many a contributor to the proceedings will name him and his work again and again in giving an account of his own research or study.

D

THE "MERZ-PRICE" SYSTEM OF AUTOMATIC PROTECTION FOR HIGH-TENSION CIRCUITS.

We recently published in these columns a description of the extra-high-tension ironclad type of switchgear which has been for some time past produced by Messrs. A. Reyrolle and Co., Ltd., of Hebburn, and in our article upon that subject we referred briefly to the "Merz-Price" system of protection which has been developed in conjunction with this gear. Considerable interest has recently been evinced in this means of protection, and in view of the remarkable success it has attained, our readers will doubtless be interested in a brief review of the principles underlying the system and the applications to which it has been put.

FIG. 1.

MERZ-PRICE BALANCED TRANSFORMERS AT EACH END OF A CABLE. ONE PHASE ONLY SHOWN FOR SIMPLICITY.

Before entering upon a description of the gear it is necessary to summarise the qualities which go to make an ideal system of protection. The chief of these is "instantaneous isolation." In order to deal successfully with a bad fault on any section of a power transmission and distribution system, it is imperative that the faulty section shall be isolated from the rest instantaneously, otherwise the disturbance develops to such an extent that sound sections of the system are isolated, and the supply is interrupted to numerous consumers.

It is also requisite that the system of protection shall be adaptable to all types of high-tension networks which have been evolved, including ring mains, loops, branched cables and multiple feeders in parallel. Moreover, the gear must be capable of discrimination, for while it must cut out a faulty section instantly, it must also be impossible for the occurrence of a fault on one section or link in the network to trip the automatic apparatus on any other section, however complex the network may be. It should here be noted that with the ordinary method of running several time-limit relays in series, a heavy fault on one section will often operate all or several of the switches on the route back to the power station, involving heavy loss of time, unnecessary labour and dissatisfied consumers. Finality in adjustment is also of importance; once the protective gear is installed and adjusted on any feeder, there should be no question of readjusting relays to suit alterations in the network, either in adjacent sections or at distant parts. The action of the relays in the isolation of any feeders, interconnectors or apparatus or other link in the system, should be limited to the effects produced by either an earth or a short-circuit in that particular link. The hunting or surging effects produced by synchronous machinery should have no effect whatever upon the protective devices, nor should a momentary interruption in the supply of current, or a drop in the pressure, have any effect upon them. Finally, with a view to reducing the gear to a condition suitable for practical work, the protective devices must be of the simplest possible nature, and the number of instruments, transformers and other component parts, and connections should be reduced to a minimum.

The above considerations are by no means fulfilled by the protective apparatus met with in common practice. Notwithstanding this, it will be evident that these are undoubtedly the requirements for ideal protection, and it is with a view to fulfilling these, that the Merz-Price discriminating system has been perfected and already installed on the extensive high-tension network that covers the industrial centres of the North-East Coast. The theory underlying the system is that a balance is created under normal conditions between the power which is flowing at the points of entry to, and exit from, the feeder, link, or piece of apparatus which is protected. The relays which are used at each end of the same are thus held inoperative so long as normal conditions exist. Should, however, a fault arise between the points of entry and exit, the equilibrium is disturbed and this action is made to instantaneously operate relays which, in turn, cause the main switches to open at the points of entry and exit. By this means the relays can only be operated when the conditions of a true fault exist, namely, when current enters at one end of a section and does not flow through the other end, or when current flows in at both ends from opposite directions and finds an exit other than its normal one. The essence of this balance system of protection is that any excess of current due to an external cause, cannot, under any circumstances, operate any section which is still in a healthy condition, though momentarily carrying the excess current, occasioned by the external fault.

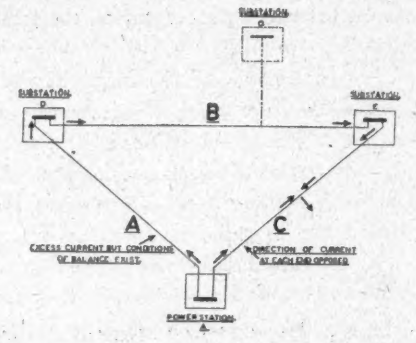


FIG. 4.

DIAGRAM ILLUSTRATING TWO SUBSTATIONS INTERCONNECTED AND FED FROM A POWER STATION WITH A FAULT ON ONE SECTION.

FIG. 2.

PROTECTIVE SYSTEM WITH CABLE FAULT EXISTING. ONE PHASE ONLY SHOWN FOR SIMPLICITY.

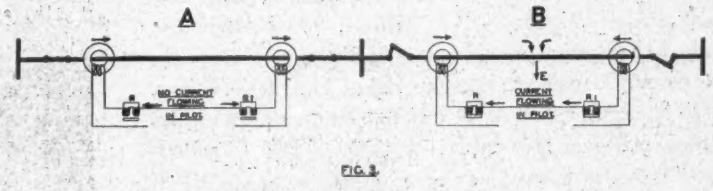


FIG. 3.

DIAGRAM TO ILLUSTRATE TWO SECTIONS OF A RING MAIN ONE WITH FAULT AND OTHER WITH STRAIGHT THROUGH EXCESS CURRENT. ONE PHASE ONLY SHOWN FOR SIMPLICITY.

It is a recognised fact that with the ordinary system of feeder protection including overload with inverse time limit and reverse current relays, a heavy fault on an outlying cable or on the machine, will often indiscriminately open switches in various sections of the system between the fault and the power station, with the result that the supply to many healthy sections is interrupted. This indiscriminate operation of the protective apparatus is easily accounted for, when it is realised that the heavy surge has to flow through several overload and reverse current relays in series and in parallel. The overload relays have their time element

adjusted at various rates which taper down from the power station end, the different adjustments being made with a view to allowing a distant fault to be cleared before switches are opened at sections nearer to the power station. It is very difficult, with a string of such time limit devices, to set the different time limits with the necessary exactitude to enable the relays to operate in their correct sequence, and even given a perfect system of setting the various relays, they cannot be relied upon to act as intended when a bad fault occurs, as on such occasions the current is so abnormally heavy that the differences in the setting of the relays are, as a rule, quite

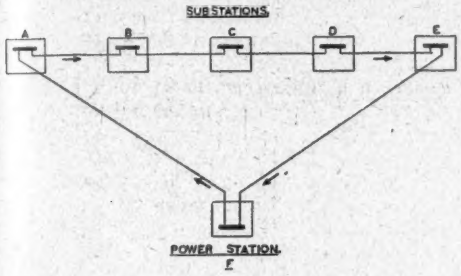


FIG. 5.

DIAGRAM ILLUSTRATING FIVE SUBSTATIONS CONNECTED TOGETHER IN THE FORM OF A RING MAIN AND FED FROM BOTH ENDS.

insufficient to prevent several of them operating simultaneously. It must be remembered that even if there is a small interval between the times of operation of the various relays (and in point of fact, under such severe conditions, the interval becomes too small to be definite), the time taken by the mechanism of the switch itself to operate and break the current is, relatively speaking, considerable, so that there is plenty of time for several relays to trip before the first switch opens. It is found in practice that reverse current relays are liable to cut out healthy sections on systems containing rotary converters. It is also easy to account for this, because, in the event of a momentary cessation in the supply from the power station, the converters, due to the momentum of the rotors, act as generators and consequently supply current back to the feeders. The direction of the current is thus momentarily reversed, and the reverse current relays operate and trip switches at most inconvenient times.

Apart altogether from these considerations, the use of reverse current relays and time limit devices set to operate at various time intervals, are quite out of the question for use on the most economical system of high-tension network, that is, the one known as a ring main. Excepting in cases where the load within the future area of supply is situated at only two or three points which lie in different directions from the power station, and at some considerable distance from it, the cheapest and safest arrangement of network is an interconnected web of cables. In this country

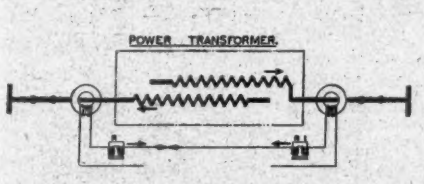


FIG. 6.

DIAGRAM ILLUSTRATING PROTECTION OF POWER TRANSFORMER. ONE PHASE ONLY SHOWN FOR SIMPLICITY.

the load in industrial areas is distributed all over the area of supply. Even in mining districts where the pits may be several miles apart, they are dispersed fairly well over the country, and it is only in isolated cases that it becomes necessary to supply a consumer situated so far from either existing or possible future consumers that duplicate feeders direct from the power station or some existing sub-station have to be laid. In all ordinary cases it does not pay to lay more than one cable over any given route, and even if the power to be supplied is too much for the carrying capacity of one cable when the other is out of commission, the cable required should in general be laid over some third alternative route, so as to cover the area, as much as possible, in order to tap future loads. With an open interconnected web of this kind each new consumer can be fed with a minimum of expense, and every point on the network obtains supply by a maximum number of different routes. The deficiencies of time-limit overload and reverse current devices have been so well appreciated, that in many cases where mains are laid in the form of a ring, or are interconnected in some more complicated way, one or more links are purposely left disconnected, the ring being only a standby. This means that the supply cannot be automatically maintained in case of breakdown, and the consumer affected will have to wait until the alternative source of supply can be switched on by hand. It also means that the capital expended in some of the cable will be idle, and the efficiency of transmission will necessarily be low. Further, were it possible to satisfactorily install overload relays with a time element, the fact that the time interval is introduced into their action is sufficient to disqualify them on account of the disorganisation caused on the system by the synchronous machinery

FIG. 7.—SERIES TRANSFORMER FOR "MERZ-PRICE SYSTEM.

being thrown out of step, and the only way to avoid this is to obtain the instantaneous and positive separation of a faulty member.

With the Merz-Price balance system it is inherently impossible for the foregoing troubles to arise. The whole of the cables forming the high-tension network may always run in parallel, so that the whole capital expended in copper is being utilised; and if each consumer is supplied by two cables, a fault occurring on one will only isolate the cable, and will not cause any interruption to the consumer. The action of any relay in this system is directly due to the combined effort of the power at both ends of a feeder, and is independent of the magnitude of the power transmitted at any instant or even of the direction of transmission.

These considerations justify the assertion that this system of balance and discrimination offers a good solution of the problem of safe protection to a high-tension system where, for the purpose of economy in mains, any required system of network may be adopted.

Turning now to the application of this system, and referring to the diagrams (which, for the sake of convenience in drawing, represent connections throughout on one phase only), these show examples of the connections for feeder protection, the direction of the current at the instant under consideration in both main and pilot

cables being indicated by arrows. In a simple form the normal conditions are represented by fig. 1. The line A is a length of feeder cable, and series transformers B and C are placed at each end. The secondaries are joined up by a pilot and under normal conditions, that is, when equivalent currents are passing through the respective primaries, there is equilibrium in the secondary circuit, the E.M.F. of the two transformers being equal and opposed to one another. Under these conditions there will be no current flowing in the pilot and the relays remain stable.

Fig. 2 represents the same apparatus, but under a fault condition. It is assumed that there is a fault at E, and in this instance an excess current will pass through the transformer C, into the fault E, and as the current is not balanced by that through the series transformer B, the E.M.F. of C exceeds that of B, and the equilibrium in the pilot circuit is destroyed. In consequence current will flow and the relays immediately operate. If the feeder forms a section of a ring main or is connected in such a way that current can be fed into the fault through both series transformers, then, as shown in the diagram, the directions of the primaries are in opposition, and this tends to increase the momentary current flowing through the pilot and relays.

In fig. 3 two sections (A and B) are drawn. These may form part of a loop or ring main or they may represent duplicate cables. In either case it is imagined that current is being fed in from both ends and that switches are provided at each end of each feeder. In the event of a fault occurring on section B, the relays at each end of this section will operate, but although during the momentary existence of this fault, there may be a very heavy current through section A, equilibrium will still be maintained in the pilot circuit of A, and so the relays will only operate on the faulty section and A still maintains the continuity of supply to the intermediate sub-station.

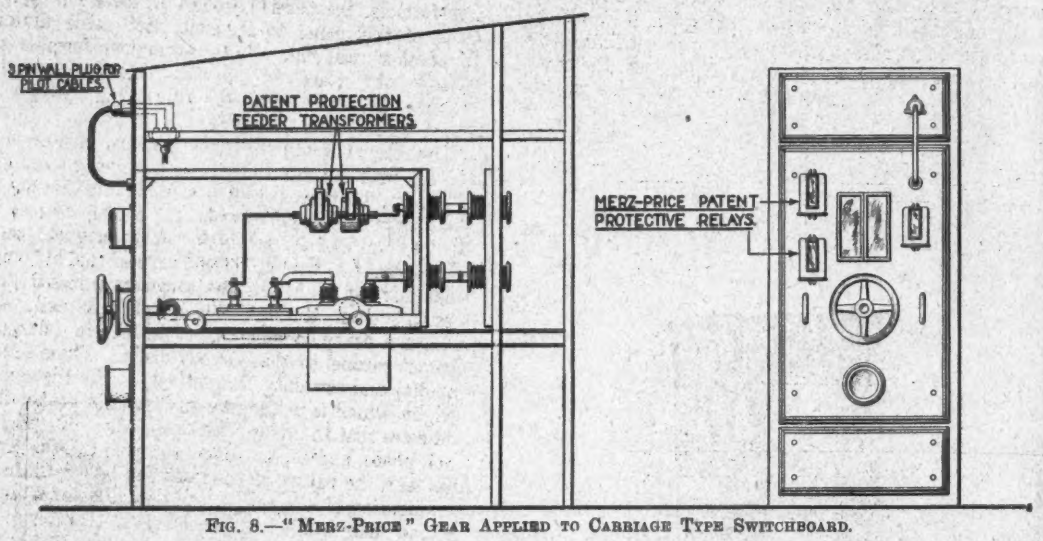


Fig. 8.—"Merz-Price" Gear Applied to Carriage Type Switchboard.

Fig. 4 represents a diagram in three sections, A, B and C, connected in the form of a ring, the two sub-stations D and E being fed from a power station A with an interconnector, B, between them. It will be obvious from the foregoing that if a fault occurs on any one of the mains, the faulty connection is automatically isolated, and the continuity of supply is maintained at both stations. Also the system may be extended to other sub-stations, as at C. In this instance it is assumed that an outlying consumer is "teed off" one of the existing mains. The series transformers for the protective gear at sub-stations D, E and C, have their secondaries coupled in series with the three relays, so that whilst this three-way link is healthy, the resultant E.M.F. in the relay circuit due to the currents passing through any two of the ends is equivalent in direction, phase and pressure to that of the third end. Equilibrium exists, therefore, whilst this section is healthy, but in the event of a fault occurring on it, the section would be disconnected without interrupting the supply to the sub-stations D and E.

As a further instance, fig. 5 illustrates five sub-stations connected together by a ring main. The "Merz-Price"

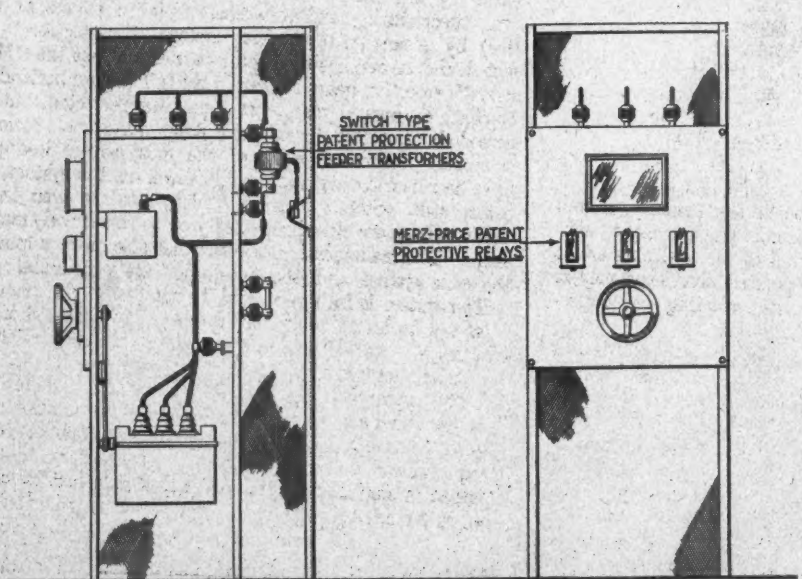


Fig. 9.—"Merz-Price" Gear; Transformers Serving as Isolating Switches.

Fig. 10.—"Merz-Price" Relay.

system not only makes such a connection feasible, so effecting a considerable saving in the cost of main cables, but as every sub-station is fed from two directions, the chances of a complete shut down at any sub-station are remote. The saving in initial cost of mains by ring mains is found to be so considerable that it more than compensates for the extra cost involved by the pilot cables. It should also be considered that all of the copper laid underground is always in commission; except in the case of a breakdown, it is never necessary to run with the ring main open at any point. With the ordinary reverse current protection, it would be necessary with this system of mains to run with one cable isolated as a standby provision. It will be seen, therefore, that the "Merz-Price" gear not only makes the system more convenient to operate, but it also effects a saving in capital, and ensures that the best use is made of material purchased by the initial capital outlay.

The same general principles of protection are applied to static transformers. Fig. 6 diagrammatically illustrates one method of connection which has been employed. In this

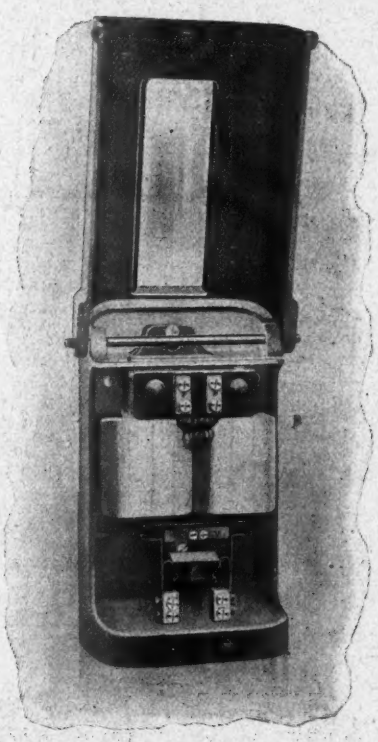


Fig. 11.—"Merz-Price" Relay, Open.

instance there would be a switch on the primary, as well as another on the secondary circuit in the same sub-station, and the tripping connections of the switches are so arranged that both switches are operated simultaneously in the event of a fault occurring on the winding or connections of the static transformer.

It is interesting to note the way in which the theoretical principles of protection elaborated above, have been worked out in actual practice as regards the manufacture of the apparatus used, inasmuch as it is one thing to determine upon a theoretically perfect system and quite another to perfect it in mechanical detail. The designs which are illustrated are the result of careful experiments under working conditions, extending over several years of actual operation on power mains having considerable magnitude, and under the most trying conditions.

Fig. 7 illustrates a series transformer as used for feeder protection. The iron core is of circular form. The primary consists of part of the cable connection to or upon the switchboard, and is merely threaded through the bore of a porcelain insulator in the centre of the transformer. A transformer so constructed can be mounted on any type of switchboard, or, if necessary, upon the wall or framework away from the switchgear.

As mentioned above, although this apparatus has been developed primarily for use in conjunction with the ironclad extra-high-tension system, it is quite adaptable to any other type of switchgear. As examples of this flexibility, fig. 8 illustrates the "Merz-Price" protective gear as applied to an existing carriage type of switchboard. On the front of the panel will be seen the single-pole relays, and in the sectional elevation are shown the series transformers which are inserted in the original conductors between the switch terminals and the bus-bars. The secondaries from the series transformers are taken through a three-pin plug on the front of the panel to a small pilot cable dividing box. In another case, fig. 9, the series transformers are made to take the place of existing isolating switches, and so serve a double purpose as isolating devices and protective gear.

The relays throughout are of the simplest design, and this coupled with the careful manufacture, has produced a device which can be thoroughly relied upon. These are shown by the illustrations, figs. 10 and 11. It will be seen that they consist simply of an ordinary electro-magnet, with a very light armature, having for the sake of rapidity in action a small air-gap. When the armature is raised, the battery circuit is made through the switch trip coil, and it also releases a heavy contact weight which, in falling, makes a contact parallel to that already made. These actions ensure rapidity and certainty, respectively. At the same time the weight, which is in the "down" position on the illustration, indicates that the relay has operated. A relay is used on each phase, and so, to some extent, in the event of an accident, the nature of the fault can be ascertained from an examination of the relays. For example, a fault to earth on one phase would trip the relay on that phase, whereas a fault between two phases would trip the two corresponding relays.

In respect to simplicity, a system based on the balance of currents possesses the advantage that it eliminates entirely the use of potential transformers and their fuses on the feeder switchgear. This feature in itself goes a long way towards improving the safety factor of the whole switchgear.

It will, perhaps, be information to many engineers to know the large extent to which the "Merz-Price" system has been already applied. Up to the present time there are in the North of England about 200 miles of high-tension network protected in this way, and the network is fed by plant of an aggregate capacity of over 50,000 kw. The lay-out of the mains has been safely extended to many outlying consumers, whom it would have been very expensive to reach by any system of mains which could be protected even theoretically (and quite apart from difficulties in practice) by means of any other system of protection. The fact should be emphasised in this connection that the "Merz-Price" protective gear has been in use in Northumberland and Durham for several years. It is not just perfected, but has passed the perfected development stage for some 18 months or more. Numerous faults of the most severe description have been isolated without visible shock on the system, and, better still, without opening healthy sections even though the switches were closed repeatedly on to the already matured fault. The transformer protection has also been applied on the same system, and, therefore, upon the same scale.

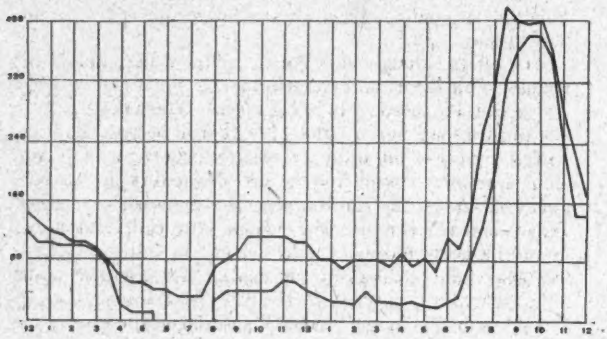
The system is fully protected by patents in the names of Messrs. Charles H. Merz and Bernard Price, for whom the designs of the switchgear section have been developed and manufactured by Messrs. A. Reyrolle & Co. It will be apparent that it affords many entirely new features which are calculated to advance the solution of the problems connected with extra-high-tension transmission of electric power in a degree which has hitherto not been attained in engineering practice, either in Great Britain, or even in America, the home of large power distributions.

New Zealand.—The Dunedin City authorities are considering the advisability of extending the municipal electrical plant, and consideration is being given to three alternative schemes, viz.:—A gas-driven plant in the city; a steam plant located on the foreshore or near the local mines; or a hydro-electric plant as an extension to the present Waipori Falls power house.

NOTES ON PUSHING BUSINESS.

By R. M. M.

Some considerable time ago, before the advent of articles on Publicity, we started a Business Department. Its birth arose from the fact that economies had nearly reached the limit, very little more could be expected from possible saving in revenue, and still the financial state was not good. Our aims and ambitions were considerable, our means to carry out the scheme were very limited—canvassing was to be done by the mains superintendent mostly in spare time, no expenses for official canvassing were allowed. We had a large percentage of dissatisfaction amongst existing consumers, and this in a very small town in which most people knew or heard of other people's business.



Summer Load Curves, showing the Influence of New Business.

The first work of the B.D. was obviously to satisfy existing consumers by seeing that, without giving anything away, they were getting decent value for their money. The next step was to try and induce consumers to be more careful in their own interests; then to have several shining examples, one in each trade, to illustrate to "prospectives" how lighting should be done, and what it should cost. This "spade" work occupied nearly a year's spare time, more especially because the power part of the load was not allowed to be neglected. During the second year, results began to appear both with regard to power and lighting, and our load curve started building up and flattening out. The third year finished with a 200 per cent. increase in power applications as compared to the previous year, and there seemed every prospect of the rate of progress continuing.

The B.D. man has to be prepared for all emergencies and all kinds of questions, and to be able to convince a consumer, that, to take care the jug does not upset again is a better policy than crying over spilt milk.

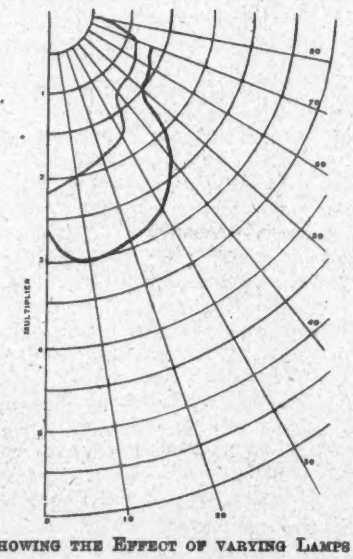
Our B.D. man took special care to establish a good reputation for veracity, and the impression that he may be "selling a pup" does not, therefore, hinder the work. (The obvious necessity for this first step, he informed us, was shown in his past experience in other towns, where he had had to cope with such statements as "Mr.—— told us that our account would be so much, here is his letter to prove it," and had spent a considerable time smoothing matters over, before it was possible to put on full steam ahead.) He is always on the look out for new scope, and worries our lives out with new ideas. For instance, a lamp testing scheme was started, and for a considerable time went well, but the carbon-filament lamp going out of fashion considerably, left the photometric staff idle, so it was obvious that something else had to be tested. We decided to go ahead with an Illumination Department, and work out reflector curves.

Of course now and then amusing incidents occur in the work, and unexpectedly the B.D. man comes across a harvest from the seed of his sowing. One of our consumers, Mr. A, had been using the light regularly for some time, but was always on the grumble. Taken *cum grano salis*, it meant nothing at all, but taken as *ex pede Herculem* by a listener knowing nothing of the true circumstances, it meant a big drag on our progress. Well, our B.D. man took a walk round, interviewed and apparently satisfied him; at all events our order went through to one of the contractors next morning for some alterations to our grumbler's lighting, and we saw no more of our man till the evening, when he came back to the works complaining of a thirst of Tantalus—had been arguing with Mr. A that there was one and only one right lamp and reflector to use to give a certain desired result. The trouble had of course been that he wished to depart from the customary stock way of lighting a window, and innovations in our town are not greatly approved of.

Mr. A's job was finished, the windows were the best lit in the town, and the cost was very reasonable (we dropped £3 per year revenue on that job) and all went very well. Several new consumers came along during the next few months, and in at least four cases it was found that Mr. A had, perhaps unintentionally, canvassed them successfully for us.

At first it was interesting to check such matters out, to discover if our B.D. work had, as well as having decreased several accounts, increased our revenue. Such a proceeding, when we go in for the most scientific Publicity Department, we shall call "keying down results," and it will no doubt be found necessary to introduce many complications of resultant curves for the sake of that accurate keying—but for the present, finding that Mr. A, as unofficial canvasser, at an unofficial salary of £3 (reduced account strictly legitimate) had brought us in £12 revenue from other sources, we judged the B.D. did not want any worrying about, as it was proving its merits.

Some time later, we heard that Mr. A was in a very bad way about his light, we sent round and found that he had been bitten, as we were afraid several of our consumers would be, over the "latest metallic-filament lamp." His point of view was correct enough, and to our mind it is a matter that should be most carefully mentioned by contractors. He had been persuaded to buy a dozen "50-c.p." metallic-filament lamps, and had put them in his windows expecting an increased brilliancy of considerable value. The brilliancy did not come off, however, for the simple reason that those lamps were rated in "Hefner" candle-power, and for another reason that whereas the reflectors our B.D. man put up for the original lighting, gave a multiplying value of 3·19 at 30° with the lamps he had installed, with the new lamps the value at 30° was only 1·73.



Curves showing the Effect of varying Lamps with the same Reflector.

On this occasion, a simple alteration was made to the relative positions of lamp and reflector which made the 30° multiplier up to 2·12, and the cost of which was very trifling. This, combined with a promise extracted from him not to buy more lamps from anyone except the local contractors, and then to avail himself of our advice, put matters right again (a case of keeping the jug from again upsetting). Mr. A was told that his dissatisfaction, when he had been bitten over the new lamps, had had the effect of putting a certain prospective consumer off. He promised to put matters right again, and as a result, an application for supply from the person in question came along within a few days.

Our B.D. has proved its value in several ways; there is as far as we know nothing that at a later date can be thrown up at the undertaking as So-and-So's guarantees—of a nature impossible to fulfil. The figures given are all based on actual results and actual hours of lighting for the district, and they are given on the understanding that they do not form a guarantee, but are merely regarded as a guide to what can be done provided the recommended scheme of lighting and method of using the light are adhered to.

We undertake contracts ourselves, but always give the wiring work to the local contractors.

It may interest some "Outside" men to see the result of our B.D. as shown in the station load curves, and for means of comparison two summer curves are given, one for the present year, and one on a similar date two years ago. The raising up of the day-load line, and the broadening out of the peak, speak for themselves.

There are also one or two diagrams illustrating the difference in value of the multiplier when the same reflector is used with a different make of lamp. Our B.D. man is bringing this last point very strongly before the contractors, as it is in the interests of all that present consumers should not have the chance of thinking they have been "done," and because accurate knowledge of such details is an exceedingly valuable help to anyone undertaking canvassing.

American methods are often relied on by stations wishing to start a load-increasing department. They are very well in their way, and the motto, "Electricity at all times, for everyone, and for all purposes," is distinctly good. A good understanding between the consumer, the contractor, the manufacturer, and the supply department, help matters along wonderfully well. It is, however, I think a great mistake to take the American as an absolute model in the business-getting line, and it is far more preferable, at all events on a small undertaking, to start on a small scale, and feel one's way.

Some people keep on trying to tell us that "Electricity is still in its infancy," and apparently they imagine that because that conviction is in *their* minds, the whole scheme of electrical business methods must also be in the same state. With this in mind, it is very interesting to know that the well-known card system for filing results, &c. (to the power of N), was indispensable to supply stations when it was a new toy only to many would-be up-to-date business offices. We, standing *in loco parentis*, can therefore be satisfied with our lusty infant and its accessories!

The business establishments are now starting going ahead, but, to a certain degree, it is the sincerest form of flattery to us; there has been a committee formed to obtain certain standardisation of papers, such as a definite coloured type or paper for invoices, another for despatch notes, another for credit notes, &c. Another branch, meaning a useful extension of the card system, is to try and get the Postal authorities to fall into line with regard to the size of their post-cards, so that certain information can be filed away in its proper place without trouble. Such reforms as these may not appear to mean much at first, but we see a saving and are going to back the matter up as far as possible. Standardisation of even load curve paper would help us!

Talking of *in loco parentis* brings up another point our B.D. man is worrying himself about, namely, the great necessity of electrical trades combining more to protect the consumer. Why should the "golden goose" be choked?

The fittings put on the market, the apparatus, the wiring, and the supply charges—surely some standardisation might be usefully carried out. Perhaps the saving clause is that, in gas matters, the consumer probably comes off worse, with the practically useless cheap, so-called Welsbach inverted burner, whose efficiency is apt to resemble that of the unstamped carbon filament lamp. The difference of the parallel comes in that, if the consumer is not satisfied in one case, the efficiency is further sacrificed by the gas-fitter's cure—making a larger hole for the gas to come through, and in the latter the cure of the unscrupulous—putting on a lamp rated at lower voltage. By all means let others live, but little and often is a better motto for profits than large and seldom. As our B.D. man says, "Put yourself in the consumer's place, and how would you like it?"

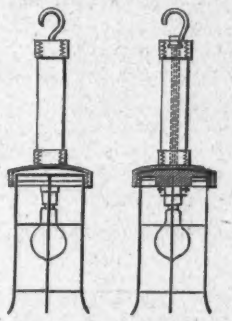
CORRESPONDENCE.

Letters received by us after 5 P.M. on Tuesday cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

Defective Hand Lamps.

A perusal of the abstract of "Electrical Accidents in 1907" (Electrical Review, August 14th, 1908), shows that H.M. Electrical Inspector to the Home Office has dealt very thoroughly with the subject of safety in the use of electrical hand lamps, the "all wood" pattern being excellent for all ordinary purposes.

Experience teaches us, however, that in very many instances, lamps of the ordinary type will remain in use for a considerable time, and, that being the case, some particulars of the



Original lamp. Converted lamp.

conversion of an ordinary brass hand lamp may perhaps prove useful. The material and labour required were such as are at hand to most users of hand lamps, and the converted lamp as shown is but little inferior to the "all wood" type.

From the original lamp the lamp-holder and support are removed, and replaced by a batten lamp-holder screwed to the centre of a disk of hard wood 3½ in. diameter, held in the body of the lamp by screwing up the cage. A piece of gauge glass tubing extends from the wood disk to the top of the handle. An inverted ebonite bush is put through the hook end of the handle, and this, on being screwed into place, clamps the tube and bush endwise; thus all live parts are entirely insulated from the other metal of the lamp.

Chas. Cuthbertson.

Longton.

The Cause of a Fire.

My attention has been called to a statement in your issue of the 14th inst., with regard to the fire at Cowfolk Lodge, near Horsham.

From inquiries that have been made of the owner, Mr. Labouchere, I find that he in no way attributes the fire to acetylene. If it had been so it would have been a unique instance of fire having been caused in any dwelling house through acetylene.

May I ask, therefore, that you will give the necessary correction in an early issue.

Lacey Downes,

Secretary, The Acetylene Association.

London, E.C., *August 24th*, 1908.

[We are pleased to publish the above correction, for we are anxious that in this matter of fires each illuminant should have common fairness meted out to it. We have become so accustomed to fires being wrongfully attributed to electricity, that for once we thought the daily Press reports had made a mistake and given the truth. We regret that they are still incorrect—but what *was* the cause? Lest any reader, after reading our correspondent's remarks, should imagine that in acetylene lighting lies the one house lighting agent which is free from dangerous possibilities, we would advise them to re-read an article on "The Demerits of Acetylene for Lighting," which appeared from the pen of

Mr. Horace Allen, in our issue of June 8th, 1906. The reports that we have a distinct recollection of reading, concerning the explosive performances of acetylene even in *dwelling houses*, must have been pure fabrications. But even Mr. Downes will not deny that such occurrences have destroyed life and property in places which cannot be strictly described as *dwelling* houses.

Accompanying Mr. Downes's letter, we have received a copy of "Regulations as to Acetylene Generators, Piping and Fittings." We are tempted to make some extracts from these, for they speak eloquently of the elaborate precautions that have to be borne in mind in laying down and operating an acetylene installation in order to avoid risk of explosions —but we will forbear!—EDS. E.R.]

Metal Filament Lamps.

We shall be glad to have the opinions of other contractors, &c., who have sold metallic filament lamps, as to whether the business done in them has been profitable, taking into consideration breakages, failures, &c. So far as we are ourselves concerned, we have found it unprofitable owing to these and other troubles, the loss on which the contractor, as middle man, has to bear, while the manufacturer refuses to replace or make any allowance.

Other opinions on this question will be welcomed by

Contractor.

Rail Corrugation.

I have pleasure in thanking "D. E." for his remarks on my theory, which you were good enough to publish in your issue of June 3rd.

I have looked up "D. E.'s" previous letter, which appeared in your issue of September 14th, 1906, and find that his theory and mine are not on all fours. My theory is, that the reversing action of the return current that takes place in a spoked electric railway or tramway wheel is the cause of a large proportion of rail corrugations.

The conditions of a steam-driven spoked wheel, whether it be on a railway or tramway, are not the same as an electrically driven one, providing, of course, that the return current is passing through the wheel to the rails.

With regard to the method of construction on the railways in this district, cast-iron pot sleepers are used on sand ballast.

In the last extensions of this electric tramway system the rails were first laid on special concrete taper blocks, made in moulds 12 in. × 12 in. at the top, 14 in. × 14 in. at the the bottom, and 6 in. thick. The rails are levelled up by means of these blocks, which are spaced every 10 ft. Planks are placed alongside the blocks, and concrete is rammed in. The rail is then grouted up with cement grout over the flange of the rail. Cross concrete ties are placed every 20 ft. around the tie-bars, which effectually prevent the gauge closing. The space between the rails is filled up with broken granite and rolled.

I consider that this method of construction compares very favourably with any first-class system, and, for the conditions here, it serves admirably.

I. F. Jones.

Madras, *August 6th*, 1908.

The Electrical Industry.

Re "Contract short-circuited." "London Manager" has thrown a sidelight on bad trade, and the case he mentions is a fair sample of the treatment that contractors receive. I am very glad to see that he would not supply the people in question. Some wholesale houses are not so particular, and appear to be only too willing to give best trade terms to anyone in any trade. I have only this month had no fewer than four cases where a certain wholesale house has supplied fittings and metal-filament lamps at full discount, when in each case the person supplied was an employé in a small factory. This indiscriminate allowing of discounts is, in my opinion, a great curse to the trade. I agree that a discount should be allowed to persons in business other than electrical, but not the full discount. Could not some agreement with the wholesale houses be come to on this question, and a definite discount be arranged for persons in other than the electrical trade? Contractors would then be at least in the same position as the wholesale houses; as it is, the customer gains the full discount, and the wholesale houses are in no better position than if they had supplied the contractor. I am adopting the system of withdrawing my orders from wholesale houses that supply my clients. Will others do the same?

Poor Contractor.

London, *August 22nd*, 1908.

The letters of Mr. Garcke and Mr. Dieppe in your current issue need cause no misgivings among the industry, because the financial methods proposed to deal with the present depressed condition of the trade will *not be adopted*.

The policy is one which may be briefly stated as that of "Call in your money and let us see who can weather the financial trumpet call." That is the policy which brought about the financial catastrophe in America, and it is proposed to apply the same measures here. It is a splendid game for millionaires, but not for ordinary commercial individuals.

What really has caused the depression?

It may at the outset be stated that the foreigners' part, although put on the screen with so much effect, has practically nothing to do with it.

How does Mr. Garcke make it out that we are being ruined by Chinese cheap labour when the foreign trade of the country is only about 10 per cent. of the home trade?

A few years ago it was one of the best money-making industries, with big possibilities looming in the future, and one which attracted finance to its support, and carried those possibilities through, and which are to-day the pride of the engineering skill of the country.

Town lighting schemes developed, tramways were established, large power companies opened out up and down the country, and electric methods have been applied in innumerable directions in private establishments.

Manufacturing firms to meet the call, launched out, enlarged their shops, and put down large machines to meet the demand made upon them for the big units.

To-day these big machines are employed in handling cwts. instead of tons. Why? Because the demand for the big unit for the time has died down; and the improvements in incandescent lamps and arc lamps has made extensions of plant unnecessary—in short, the *big* market of the electrical engineer has been worked out.

The man of science, with his improved low current lamps, has hit the engineer hard, and he must wait a bit until natural developments and commercial enterprise bring about improvements. These low current lamps will ultimately be the salvation of the industry.

The success attending the industry was so great that it attracted other engineers into the field, and where a few years ago there was one manufacturing firm there are now half-a-dozen. The big firms, now having no great machines to manufacture, and no great tramway undertaking to cater for, find that the large number of smaller firms are active competitors with them. The only rational result to the expenditure of such enormous energy on the part of the big firms, and the vitality of the fresh but smaller firms, must be a depression.

All the Marathon racers cannot come in fresh after the heat and burden of the day.

But is it really necessary to adopt a policy of kicking out *those who can reach the goal* if given time to do so?

There is undoubtedly a large amount of work in the country, but it is divided amongst a larger number of contractors, and this is an infinitely healthier condition for the country generally than that there should be only a few large manufacturers.

To deal with this depression—an inevitable depression—the scheme is one to bring about a panic in the industry, which will be reflected in other industries—and what for—to initiate a policy of protection?

Mr. Garcke's remarks about foreign enterprise are, I fear, not very happy, unless he wants other countries to treat in

the same spirit our enterprising commercial agents abroad whose energies have resulted in our enormous trade of to-day.

The success of the foreigner, of which we are so envious, particularly that of the German, is due to his common sense in organising his consular services and pushing ahead, while our consular service is of so little commercial advantage to the country, and costs more than any other.

Mr. Garcke says the Government is entirely apathetic. That can be denied absolutely, as there has not been a government in our time which has studied more the best interests of the country.

By all means let there be a conference of the electrical industry, the object of which should be improvement, not disorganisation. If the latter is to be the policy, it is doomed to failure before it starts.

If the Government is approached by duly appointed representatives from such a conference, with the object of a thorough inquiry into the state of trade, and what remedies should be adopted for improvement and better regulation of trade, the drastic overhauling of our consular service, and the appointment of a Minister of Commerce, it would not take many months to get to the root of any real existing evils.

One of the evils to overcome is the policy of some of the local authorities, such as that of Macclesfield, for instance, where powers exist for inaugurating electrical supply, but where they absolutely refuse to put down a station and prevent a company taking up the work.

As Mr. Garcke says, the scope for electrical enterprise is considerable; the right thing to do is to obtain such powers as to prevent local authorities from stopping developments, the other is the formation of companies on a financial basis, which will secure good returns, and the securing of such arrangements as will make it possible for companies and local authorities to combine their finances for their mutual advantage and the welfare of the community.

Socialist.

RAPID PRELIMINARY CALCULATION OF ILLUMINATION.*

By J. R. CRAVATH and V. R. LANSINGH.

In the first few years of its existence, the art of illuminating engineering has had to depend for its calculations of illumination made in advance of the installation, on the laborious method of figuring the foot-candle intensity point by point over the area under consideration. This method does not give the true average foot-candles, unless the foot-candles are calculated for a sufficient number of equally spaced points over a section of room large enough so that the average of these points represents the true average of the room. The ordinary method of taking the illumination at different typical points and averaging them does not give the true average in most cases. Furthermore, such calculations have not taken into account the increase in illumination due to reflection from ceilings and walls.

Tests of the actual illumination produced in various installations, if properly measured with an illuminometer or portable photometer, are more satisfactory and more easily applied foundations for preliminary calculations of illumination than the point-by-point method.

There have been made in the past two years sufficient reliable tests of the illumination of actual installations, so that it is possible to predict results for a considerable number of given conditions. The authors have compiled from various sources the table given herewith, which shows the watts per square foot received to produce an average illumination of one foot-candle on a plane about 30 in. from the floor in various large rooms with various electric lighting equipment. This is the numerical equivalent of watts per lumen.

In compiling this table the attempt has been made to give figures which will represent average conditions with lamps and reflectors reasonably clean and lamps within 10 per cent. of rated candle-power. Such favourable conditions frequently do not exist due to dirt, blackened lamps or low voltage. The figures in the tables are mainly derived from measurements in large rooms, reported in the *Transactions* of the Illuminating Engineering Society and the Association of the Edison Illuminating Companies, and also tests by the authors. The uniformity of illumination (that is, the difference between the maximum and minimum) will depend, of course, on the number and spacing of the lamps and the distribution of light from each lamp; that is, whether it is concentrated or distributed.

The practical application of this table will be shown by the following examples:—

Suppose we wish to light a large store 50 ft. wide by 100 ft. long, having 5,000 sq. ft. of floor area, with light ceilings and dark walls. We wish to obtain an average illumination of 3 foot-candles on the counter level. Looking at the table, we see that if we use tungsten lamps with prismatic bowl reflectors, 1 foot-candle will require 0·25 watt per square foot. Practical experience has also demonstrated that with units spaced apart not more than twice their height above the plane illuminated, the illumination will be very uniform in such a case. It will, therefore, take 5,000 sq. ft. × 0·75, or 3,750 watts to illuminate the room in this way. If 100-watt lamps are used, 38 would be needed. Four rows of nine lamps each would take 36 lamps. Other combinations can, of course, be worked out.

For another example, suppose a large general office room, 40 ft. × 40 ft., area 1,600 sq. ft., which we wish to illuminate with an average intensity of 4 foot-candles with Nernst single-glower 110-watt lamps. Looking at the table we see that 1 foot-candle with such lamp equipment requires 0·5 watt per square foot. Multiplying 0·5 by 4 foot-candles gives 2 watts per square foot. For 1,600 sq. ft., therefore, twice this, or 3,200 watts, would be required. Twenty-nine 110-watt lamps will serve the purpose. Five rows of six lamps each, or 30, would probably be the best arrangement to adopt for reasons of symmetry.

The simple rule for the application of this table is as follows:—
Total watts = area room × foot-candles × constant from table.

Table Showing Number of Watts per Square Foot of Floor Area required to Produce an Average of 1 Foot-Candle of Illumination. (Watts per Lumen.)

Incandescent Lamps.	
Tungsten lamps rated at 1·25 watts per horizontal candle-power; clear prismatic reflectors, either bowl or concentrating; large room; light ceilings; dark walls; lamps pendant; height, 8 to 15 ft.	0·25
Same, with very light walls	0·20
Tungsten lamps rated at 1·25 watts per horizontal candle-power; prismatic bowl reflectors, enamelled; large room; light ceiling; dark walls; lamps pendant; height, 8 to 15 ft.	0·29
Same, with very light walls	0·23
Gem lamps, rated at 2·5 watts per horizontal candle-power; clear prismatic reflectors, either concentrating or bowl; large room; light ceiling; dark walls; lamps pendant; height, 8 to 15 ft.	0·55
Same, with very light walls	0·45
Carbon filament lamps, rated at 3·1 watts per horizontal candle-power; clear prismatic reflectors, either bowl or concentrating; light ceiling; dark walls; large room; lamps pendant; height, 8 to 15 ft.	0·65
Same, with very light walls	0·55
Bare carbon-filament lamps, rated at 3·1 watts per horizontal candle-power; no reflectors; large room; very light ceiling and walls; height, 10 to 14 ft.	0·75 to 1·5
Same; small room; medium walls	1·25 to 2·0
Carbon filament lamps, rated at 3·1 watts per horizontal candle-power; opal dome or opal cone reflectors; light ceilings; dark walls; large room; lamps pendant; height, 8 to 15 ft.	0·70
Same, with light walls	0·60
Nernst Lamps.	
110-watt, single-glower Nernst lamps; opaline ball globe; no reflectors; large room; light ceiling; medium walls ...	0·50
Arc Lamps.	
Five-ampere enclosed direct-current arc on 110-volt circuit; clear inner, opal outer globe; no reflector; large room; height, 9 to 14 ft.	0·50

Japan and the Rubber Industry.—The Canadian Department of Trade and Commerce publishes a report by the Canadian Trade Commissioner at Yokohama, to the effect that a representative of a French syndicate is negotiating to bring the rubber factories in Japan into co-operation with certain large manufacturing concerns in Great Britain and France. The intention is to supply the local markets, and eventually secure the export business to Korea, China, India, Siam, and the Straits Settlements. At present, the Commissioner states, there are six companies engaged in the rubber industry in Japan. So far, the quality of rubber goods manufactured by these factories has not been first-class; but, nevertheless, the product is replacing the imported article. The local product has not altogether met with the approval of the public, on account of its weakness and inability to stand wear. One or two of the establishments, however, have made changes in the basis of the material from which their goods are manufactured, charging a considerably increased price, and have placed articles on the market quite equal to the best of the kind that have been imported.—*Financial News.*

E

* *Electrical World.*

THE PURCHASE OF COAL ON A SCIENTIFIC BASIS.

By "IGNOTUS."

An article recently appeared in the Electrical Review under the above title, and appears to be a *résumé* of another article by Mr. J. B. C. Kershaw, originally appearing in *Cassier's Magazine*. The combined effect of the clauses drawn from the original article, and the reviewer's comments as appearing in the Review, appears to place the coal industry, or the English members thereof, in a somewhat unfavourable light, so that a few notes on the question of buying coal for industrial purposes, from the coal seller's point of view, may be of interest.

In the first place, the assumption in the article that British coal merchants are averse to modern methods of coal selection is, it may be argued, considerably wide of the mark. The rule which must apply to all contract work in engineering, that the vendor must know as much about the article on sale as the buyer, holds good in coal dealing. A coal factor is very often in the position of actually having to advise a buyer as to the quality of coal to be selected, having regard not merely to the intrinsic quality of the fuel, but also in relation to furnaces or other purposes for which it is to be used. Cases frequently arise where the particular design of a furnace precludes the use of certain coal, which, under other conditions, would yield excellent results, and the coal factor from his particularly wide knowledge of the coals available to the market, and his past experience of the behaviour of classes of coal as reflected by the continuity of his coal sales to different customers, can often render valuable help to the person who has to buy the coal.

For this reason, if no other, every British coal factor who takes his profession seriously, welcomes any scientific test which will help him to predetermine the performance of the coal for which it is his duty to find a market.

The rock upon which the article under discussion appears to split, is the undue prominence given to calorific value pure and simple. The writer of the article recommends the chemical testing of the fuel. This is a very useful step to take, and the results of analysis should be carefully studied in selecting coal. It must be remembered, however, that what is ultimately aimed at is working performance, of which the only conclusive test is the trial of a sample ton under ordinary working conditions, by a skilled fireman free from bias. This may be illustrated by the following two analyses, and their working results. The first represents the composition of a grade of Northumberland steam coal which has been largely used in the North. The second is of Durham extraction :—

A.—Northumberland Sample.		B.—Durham Sample.	
Fixed carbon ...	60·39 per cent.	Carbon	75·05 per cent.
Volatile hydro-carbon ...	32·05 „ „	Hydrogen ...	4·78 „ „
Sulphur ...	1·44 „ „	Oxygen	8·01 „ „
Ash	4·58 „ „	Nitrogen ...	1·83 „ „
Moisture ...	1·54 „ „	Sulphur	0·67 „ „
		Ash	1·40 „ „
		Water	8·26 „ „
	100·00 per cent.		100·00 per cent

The calorific value of the first sample, as judged by the pounds of water raised to steam, both at a temperature of 212° F. was 13·76 lb., while that of the latter was 13·7 lb. As regards this point, therefore, both samples are practically equal. When, however, these two classes of coal were tried under working conditions, the second sample turned out, in a particular case, so much superior in result to the first, that it was unhesitatingly adopted and retained. This might be explained by the difference in nature of the two coals and the particular requirements of the furnaces in which they were used, and the comparison is made without any prejudice to the abstract qualities of either of the coals mentioned, in order to indicate that something more than a chemical analysis is necessary to determine whether a coal is suitable *for a particular purpose*. That "something" is, in nine cases out of ten, the mercantile or special knowledge possessed by the coal factor of the classes of coal which he is offering. All this is mentioned, of course, without the slightest intention of detracting from the undoubted value of the chemical test, properly understood and applied.

The writer of the article under consideration evidently recognises that calorific value is not the only criterion, in spite of the American example of fuel contract, whose price varies with the calorific value, inasmuch as he points out the value of a low ash content as inducing low cost of waste cartage and diminution of waste of live coal mixing with ash. The example given of a cheap line of coal having 11 per cent. ash and over 7 per cent. of moisture being rejected in favour of a coal with less ash and costing more per thermal unit, amply illustrates this point. Once again the value of practical experience in coal buying and using is demonstrated.

In the criticism of present methods of buying coal, Mr. Kershaw seems to doubt the possibility of proof that the user always gets the coal from the same seam or colliery, even after he has ordered it. In such a district as Northumberland or Durham, which is a large ship-building centre, the result of a firm failing to provide a uniform quality of coal would be that the men would, previous to the Edinburgh agreement, very promptly go on strike. From long usage, under uniform conditions, they are very well qualified to judge as to the uniformity of their fuel. They are expected to get certain results from their fires. They know they can get them if fairly treated, and their method of remonstrance is usually very salutary in effect. Speaking generally, if a user of coal, buying from merchants, takes landsale coal, *i.e.*, coal purchased from collieries in the vicinity and supplied by rail, he can always get a check on the colliery from which he is getting his coal, by looking at the railway tickets. If Mr. Kershaw is referring to the London district, where the bulk of the coal used is seaborne, there can, of course, be no guarantee that the coal is not more or less mixed, inasmuch as it is shipped in large lots. Coal factors are, however, sufficiently alive to their own reputations to see that the quality of the coal shipped does not fall below the specified standard, and it is no uncommon thing for them to keep men specially stationed at the coal staithes in order to inspect each lot of coal as it arrives, and if it shows signs of inferiority, to blend with it an amount of extra high-class coal to fully restore the balance.

To require that all the coal should come from the same seam of a colliery is the sort of thing one expects from those exacting gentlemen known as electrical engineers, whose minds have been trained to the perception of decimal points, and who are not, perhaps, accustomed to the variability of quality which accompanies a large proportion of vendible articles. If a colliery is working one seam only, it is quite reasonable to stipulate that coal from that seam alone is secured. If, however, it is getting its output from two or three seams at different levels, it is nearly always found that the coal from these seams is mixed at the pit mouth, and the various qualities sent out are products of various seams. The process of discrimination is usually carried far enough when the product of one particular colliery is specified.

The sting of the article under consideration is in its tail. The path of the coal seller who relies for his sales on payments to firemen is somewhat hampered—to put it mildly—by the Prevention of Corruption Act of 1906. Apart from that, any firm of coalbrokers of any magnitude is deterred from trafficking with firemen by the fact that a change of stokers would tell its own tale, that men with a little liquor are often needlessly communicative, and that the result of suspicion on the part of the coal buyers would not only stop the steady sale of an article in regular requirement by the firm, but that evil report would rapidly spread by word of mouth in a manner that can be easily imagined by any business man in a competitive line, and would soon wreck the factor who descended to such methods. As to the suggestion that undue influence is exerted with directors of companies, one would suggest for the writer's consideration that most directors have a considerable financial stake in the success of their undertaking, and their acceptance of a consideration of any sort to deter them from getting the best value possible for their money, would argue that the services of the nearest mental specialist should be invoked on their behalf.

The subject of these notes is somewhat outside the

ordinary scope of an electrical engineering paper, but in view of the large number of power and lighting companies, and corporations which depend for their existence on the conversion of the energy of coal into electricity, it is possible that they will have a certain value to some of the readers of the ELECTRICAL REVIEW.

THE USE OF METERS ON TRAMCARS.

[COMMUNICATED.]

THE question of registering the consumption of electricity on tramcars has long held the attention of those concerned in the economical running of tramway and light railway systems, but the effort towards obtaining reliable measurements have been to a certain extent hindered by the difficulties attendant, not only on the construction of apparatus necessary to register the energy, but also the provision of a suitable scheme of applying the knowledge obtained to the more economical working of the cars. It is now, however, possible to obtain several types of meter which are capable of fulfilling the requirements of accurate register, even when subjected to vibration and other troubles incident on being placed in the car, so that as far as their adoption on traction systems is concerned, there need be no hesitancy.

That there is a great saving attached to the use of such meters is now beyond question, especially if some form of bonus be given to those drivers whose energy consumption is below some specified figure which the manager of the tramway has found by previous experience can be obtained by careful driving, and it is on the establishment of such a bonus system (in the writer's opinion) that the true value of the tramcar meter is founded. A manager, who is dissatisfied with his average energy consumption per car, can adopt threats or other means towards his employés, considered in bulk, but without a very expensive system of inspection it is impossible for him to select the men who are chiefly responsible for the waste of energy, and he can only, therefore, enjoin general carefulness. If, however, meters are fixed, the effect will be startling, the consumption will come down gradually, and if the bonus system is in vogue, there will be endless reports of faults on the cars, which were never heard of before, and which will be discovered by the drivers to account for their high consumption. Moreover, it will be found as the result of the steadier driving which the metered cars require in order to secure economical running, that the whole equipment will not be the subject of such heavy maintenance as previously prevailed without meters. There will be none of the careless sudden starts and stops and undue use of the brake to counteract wasteful current running where coasting would have been sufficient.

Exact figures as to the actual saving on maintenance as to current consumption are difficult to obtain, as those tramway managers who have used metered cars appear to be somewhat loath to publish their results. It may, however, be taken to range from 10 to 15 per cent., and this saving is worth a considerable amount of trouble and certain initial outlay, in order to secure this result on the year's energy bill.

A difference will, of course, be found in the sum total of all the car-meter readings, and the total quantity measured at the generating station during any particular time. This may be put down partly to the losses in cables, and also to the net result of small inaccuracies of the car meters. The difference is not an easy one to obtain from published results, but the energy unaccounted for by the meters might be placed at about 20 per cent., and an allowance should be made for these lost units in working out a bonus scheme, should this be tried.

There are several points to be watched in the adoption of a bonus system, the first being that if the total consumption of the system is taken and the average worked out so that all the drivers share equally, some are getting a bonus who do not really deserve it, while others of the best men will be poorly rewarded for their economical driving. A better method is to take a system of working each driver's records out from the readings of the meters on their respective cars. The disadvantage to be encountered in this method is that some cars will run considerably easier than others along the same route, and therefore the same driver would get different results on different cars; moreover, if the equipment is from time to time overhauled in any way, and new brakes, new bearings, and other details are put in, different results will be obtained on the same car from time to time. Yet, again, one driver may have on a certain turn a strong wind and greasy rail, while another man will have all the conditions in his favour. If, therefore, the last suggested scheme be adopted, it should be endeavoured to bring about as much change as possible in the cars allotted day by day to each driver, and to take the average result over an extended period of, say, a month, so that during that time all drivers will have a fair share of various conditions of weather, permanent way and cars. Under such an arrangement the best drivers will soon be found out, and it will invariably be found that the drivers maintain similar positions in the table of averages month by month.

It may be interesting, in order to consider the question from a financial point of view, to take the case of a system having 40 cars, and consuming one million units per annum. As regards the prime cost, we may take the value of a meter at £4, the set of 40 meters will take a mechanic and labourer about three weeks to fix, and if we reckon their wages at £3 10s per week, we get £10 10s. as the cost of fixing.

It will probably be found that the cost of maintenance and repairs to the meters will work out at about 10 per cent. of the prime cost, we, therefore, have the following table:—

40 meters at £4 each	£160	0	0
Fixing, say...	10	10	0
Maintenance at 10 per cent.	16	0	0
	£186	10	0

Now it is assumed that the electricity is supplied to the cars at a cost of 1d. per unit. We have stated above that the probable saving by the use of meters on the cars will be 10 per cent of the total units. This equals £416 13s. 4d. saving. The difference between this saving and the cost of fixing and that of maintenance will be £230 3s. 4d. Now, if there are 72 drivers whose bonuses average 2s. 6d. per month, or £1 10s. per annum, there would be paid £108 in bonuses, and the net result would be that on the first year's working with meters there would be a saving of £122 3s. 4d. on the current bill, if the first cost of the meters had been wiped out in that year's running.

It will, therefore, be seen that there is an appreciable amount to be saved, even on the smallest tramway system by the adoption of meters, and even if the first year's working does not show a clear profit on the meter installation, as it would in ordinary conditions, it would be certain to be wiped out in the second year, while the life of a meter under these conditions can easily be reckoned at from three to five years. The figure given will be found to be below the average tramway returns, so there is no reason why there should not be a considerable improvement on the saving previously indicated.

In conclusion, it should be carefully noted that there will be no possible advantage in putting one or two meters on a tramway system for trial, unless it is simply to find out the reliability of the meter alone. To obtain proper figures and economy, it is necessary that all the cars should be fitted, and then, and not till then, a proper grasp of the conditions of economical working of the cars would be obtained.

FORMS FOR THE USE OF ELECTRICAL UNDERTAKERS.

BY OUR LEGAL CONTRIBUTOR.

IN view of the fact that companies and local authorities who supply electricity are "the creatures of statute," it is important that the requirements of the statutes and provisional orders should be strictly complied with. In these circumstances it is essential that statutory notices should be drawn with care. It must not be forgotten that in carrying out the work of supplying electricity, the undertakers are exercising a species of limited monopoly (if we may use the expression), and must not exceed their powers. Again, in dealing with consumers, the company or the local authority are entitled to exercise certain rights and privileges, but those rights can only be exercised in accordance with the requirements of the Provisional Order and the public Electric Lighting Acts. In these circumstances it may be useful to set out and illustrate with explanatory notes a few forms which must be used (*a*) for the purpose of establishing a system of supply in accordance with the terms of a Provisional Order; (*b*) for the purpose of making the necessary agreements with consumers, or prospective consumers.

Inasmuch as the form of Provisional Order which is embodied in the Electric Lighting (Clauses) Act, 1899, is now incorporated with nearly every Provisional Order, the following forms and notices have been drafted on the lines of that schedule. Before applying the forms for the purposes of any particular undertaking, it should be made certain that the Provisional Order under which the local authority or company supply electricity contains no provisions which materially depart from the common form.

(a) Notices required prior to and during the establishment of an electricity supply undertaking.

Rule V of the Board of Trade rules provides that any local authority, company, or person intending to apply for a Provisional Order must on or before November 1st give notice in writing of their intended application to every local authority, company, or person authorised to supply electricity under statutory powers within the district to which the proposed application refers.

Where a company is applying for a Provisional Order in a district, it is essential that a notice of this kind be given to the local authority (Electric Lighting Act, 1882, Sec. 4 (i)). The notice must be served either by leaving it at the offices of the local authority, or by forwarding it by post in a registered letter.

The following is a convenient form of notice which should be served in order to comply with this rule:—

1. *Notice of application for a Provisional Order for the supply of electricity within the township (or district) of .....*

The ..... Electricity Supply Corporation, Ltd., (or the Urban District Council of .....).

Take Notice that the ..... Electricity Supply Corporation, Ltd. (or the Urban, &c.)., being a limited company incorporated under the Companies' Acts 1862 to 1900, whose registered office is at ..... (or the Urban, &c.), will apply to the Board of Trade on the ..... day of October, 190 , for a Provisional Order to enable them to supply electricity to consumers within the township of ..... (or within the Urban District of .....).

Dated this ..... day of ..... 190 .

(Signed) A. B., Director,
C. D., Secretary,
of the said Company.

[or] E. F., Chairman,
G. H., Secretary,
of the Urban District Council of .....

Note.—In the case of a local authority, the notices must be served on or before July 1st in the year in which the application is made.

A notice of an intended application for a Provisional Order by a Local Authority might also be in the following form:—

2. *Advertisement of application for Provisional Order by the Local Authority.*

No. .....

Whereas, by a resolution passed at a meeting of the ..... Corporation on the ..... day of ....., and duly convened in accordance with the Statute 45 and 46 Vict., c. 56, Sec. 3, Sub-sec. (6), it was resolved that an application should be made to the Board Trade, on or after the ..... day of ....., for a Provisional Order to supply electricity within the area and for the purposes hereinafter set forth. Notice is hereby given, in pursuance of the Statute 45 and 46 Vict., c. 56, Sec. 3, Sub-sec. (5), and the Board of Trade Rules, 1890, Nos. XIII and XVII, that the said Corporation intend to apply to the Board of Trade, on the ..... day of October (or November), for a Provisional Order to enable them to [*here follow the objects of the undertaking*].

2. The area in which the said Corporation propose to supply electricity as aforesaid is as follows:—

3. The said Corporation propose to lay down electric lines in and through the streets following, that is to say:—

[*Here describe the streets with particularity. A plan should be sent showing in blue ink or wash the streets in which the lines are to be laid.*]

(Signed)

Rule XIII of the Board of Trade Rules provides that applicants for a Provisional Order must publish notices by advertisement of their intended application. Such advertisement must be inserted once at least in each of two successive weeks in one and the same newspaper, published and circulating in the proposed area of supply, or in such other newspaper as the Board of Trade may direct; and once at least in the London, Edinburgh, or Dublin *Gazette*, accordingly as the proposed area of supply is situate in England, Scotland, or Ireland.

3. *Form of advertisement of intended application for a Provisional Order.*

The ..... Electricity Supply Corporation [or The ..... District Council of .....].

---

1. The Electricity Supply Corporation [or The ..... District Council of .....], being a limited company incorporated under the Companies' Acts, whose registered office is at ..... (or being the Local Authority), hereby give notice of their intention to apply to the Board of Trade, on the ..... day of October (or November), for a Provisional Order to enable them to [*Here follow the objects of the undertaking*].

2. The said Corporation seek to obtain power to break up, or otherwise interfere with, the following streets, which are not repairable by the Local Authority:— [*Here set out the names of the streets.*]

3. The said Corporation propose to break up, or otherwise interfere with, the following tramways and railways, namely:— [*Here describe the tramways which will be interfered with.*]

4. Copies of the draft Provisional Order can be obtained at a price of ..... [*price not to exceed* 1*s.*], either at the offices of the Company, situate in ....., in the County of London, or at ....., within the aforesaid area of supply.

5. Every local or other public authority, company, or person desirous of bringing before the Board of Trade any objection respecting the aforesaid application, must do so by letter addressed to the Board of Trade, marked on the outside of the cover enclosing it "Electric Lighting Acts," on or before the 15th day of January, 190 [*mentioning the year after that in which this advertisement is published*].

(Signed)

Dated ..... [*Some date prior to November* 1*st*], 190 .

[This advertisement is published by the undertakers pursuant to the 45 and 46 Vict., c. 56, Sec. 5, and the Board of Trade Rules, August, 1890.]

4. *Form of notice of works to be served on the Postmaster-General and Local Authority.*

(Pursuant to Sec. 14 (1) of the Schedule to the Electric Lighting Clauses Act, 1899.)

No. .....

The ..... Electricity Supply Co., Ltd.

Proposed interference with streets in the Parish of ....., within the district of the said Company.

To the Right Hon. ....., Postmaster-General [or to the ..... Urban District Council, being the Local Authority for the district in which the following streets are situated].

Take Notice that, on or after the ..... day of ....., 190 , the above-named Company propose to break up or otherwise interfere with the following streets [or bridges], that is to say:— [*Here enumerate the streets or bridges.*]

1. The nature of the proposed works is as follows:— [*Here describe the proposed works.*]

2. The said works are indicated upon the plan [or plans] delivered herewith.

3. This notice is delivered in accordance with Section 14 of the Schedule to the Electric Lighting (Clauses) Act, 1899 (63 and 64 Vict., c. 19), to the provisions of which your attention is invited.

4. Further information with regard to the Company's said proposed works will be furnished on application to [*Here state the name of the Company's Engineer and his address at the office of the Company*].

(Signed)

Dated this ..... day of ....., 190 .

[Note.—The date of the notice should be not less than one month prior to the date upon which the company intend to commence their works. No part of the month of August is included in calculating this period of one month.]

If the undertakers make default in complying with any of the requirements or restrictions of the section which necessitates the above notice, they must pay compensation to the Postmaster-General and the Local Authority. They are also liable to have to pay penalties. (E. L. (C.) Act, 1899, Sec. 14 (1) (f).)

Where the exercise of the powers of the undertakers in relation to the execution of any works will involve the placing of any works in, under, along or across any street or part of a street not repairable by the local authority, including where the area of supply is not wholly in a county borough, the County Council, or over or under any railway or canal, due notice of the intended works must be given. (E. L. (C.) A., 1899, Sec. 15.)

5. *Form of notice under Sec.* 15 *of the Schedule to the Electric Lighting Clauses Act*, 1899, 63 *and* 64 *Vict., C.* 19, *to a company or person liable to repair a street or owning a tramway liable to be interfered with.*

No. .....

The ..... Electricity Supply Co., Ltd. (or the Urban District Council of .....).

Interference with streets in the parish of ..... not repairable or under the control of the local authority.

To ..... , being the person or persons for the time being liable to repair ..... Street [or being the owners of the tramway running through and along the streets of ..... and .....], or so much thereof as is situate within the district which the said company are entitled to supply with electricity.

1. Take Notice that on or after the ..... day of ..... 190 , the Company purpose to break up, or otherwise interfere with, the following streets [or tramways or railways], that is to say—[*Here describe the proposed works in detail.*]

2. The nature and position of the company's proposed works are indicated upon the plan or plans delivered herewith.

3. This notice is delivered in accordance with Sec. 15 of the Schedule to the Electric Lighting (Clauses) Act, 1899 (63 and 64 Vict , c. 19), to the provisions of which your attention is directed.

4. Further information with regard to the Company's said proposed works will be furnished on application to ..... [*Here state the name of the Company's engineer, and his address at the office of the Company.*]

(Signed)

Dated this ..... day of ..... 190 .

Note.—The date of the notice should be not less than one month prior to the date upon which the company intend to commence their works.

The following form is sometimes used:—

No. .....

To the Engineer and Surveyor of the Corporation of .....

Notice of Breaking up Streets.

We give notice that, under the powers of our order, we intend on ..... the ..... day of ..... to commence breaking and taking up the pavement or ground of the street or road known as ..... in the Borough of .....

Dated this ..... day of ..... 190 .

For the ..... Electric Supply Co.,
.....

Where it is proposed to lay cables under a railway or canal, the notice to the railway or canal company should be in the following form :—

6. *Form of Notice under Sec.* 15 *of the Schedule to the Electric Lighting (Clauses) Act*, 1899 (63 *and* 64 *Vict., c.* 19) *to a railway or canal company.*

No. .....

The ..... Electricity Supply Co., Ltd. (or the Urban District Council of .....)

To ....., being the owners of a certain line of railway, namely [*Here describe the railway*] or so much thereof as is situate within the district in which the above-named company are entitled to supply electricity.

1. Take Notice that on or after the ..... day of ..... 190 , the Company require to lay cables (or to carry out certain works, *e.g.* .....) under the line of railway now worked by you at the point marked on the plan delivered herewith.

2. See Form 5 (3) *supra.*

3. See Form 5 (4) *supra.*

Dated this ..... day of ..... 190 .

7. *Notice of Reinstating Streets.*

No.

To the Engineer and Surveyor of the Corporation of .....

We give you notice, under Sec. ..... of our Order, to commence repairing and reinstating the pavement or ground of the street or road known as ..... in the Borough of ....., broken up under notice numbered ..... and dated ....., within ..... hours from time of service hereof.

Dated this ..... day of ..... 190 .

For the ..... Electric Supply Co,.

.....

(*To be continued.*)

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

20,000-Volt Dividing Box.

Dividing boxes of the size which we illustrate in fig. 1 are somewhat unusual, in this country at least, but we understand that Messrs. A. Reyrolle & Co. now include these in their extensive

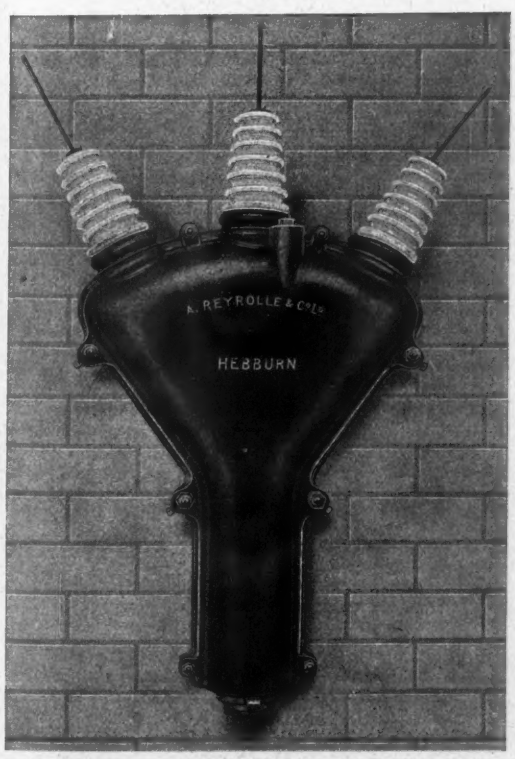


Fig. 1.

line of high-tension accessories. The box is 3 ft. 3 in. high, contains 1½ cwt. of compound, and weighs 2½ cwt. complete. This box is claimed to be of particularly substantial construction, and to allow plenty of room for making joints inside. It is capable of withstanding a pressure of 60,000 volts between the conductors of each phase and earth.

Witton Grip Fittings.

The Armoraduct Manufacturing Co., Ltd., of Farringdon Avenue, London, E.C., wish to draw the attention of the trade to the

Fig. 2.

fact that they can now supply from stock, ceiling rose fittings for use in connection with their Witton grip continuity system. An example of a switch base on this system is illustrated in the accompanying figure (fig. 2).

BUSINESS NOTES.

Consular Notes.—Germany.—The *Standard* quotes some interesting facts as to German industry given by Consul-General Sir Francis Oppenheimer, in his report on the trade and commerce of the Consular district of Frankfort for the year ended April last. Sir Francis states that the commercial boom came to a definite end in 1907. He adds that while those most intimately connected with German industry hesitate to express an opinion as to the probable duration of the prevailing depression, there is generally an inclination to believe that, if it will not be so deep as former periods of depression, the very fact of its comparative shallowness may cause it to be spread over a longer period. Instructive reference is made to the extension of the application of electrical power in Germany. The substitution of electrical power for steam power on railways with extended systems, has already become the subject of official inquiry, and quite recently the Bavarian Government, which, owing to the geographical position of Bavaria, has at its disposal enormous water-power, has worked out statistics showing the quantity of power needed. It was calculated that the Bavarian State Railways alone would require a daily average consumption of 1,435,000 kw.-hours, with at least an additional 10 per cent. as a margin for emergencies. The Prussian State Railways intend to introduce electrical power in place of steam on certain lines within the railway directorate of Magdeburg; the change will not be effected for some time to come, but the decision was welcomed because it shows a departure in the right direction, and one which, heretofore, the German State railways had persistently declined to take.

Already central power stations supply all industries in ever-increasing areas. Statistics have been published repeatedly to show how soon the coal supply in the various coal-producing countries will be exhausted if the demand continues to increase proportionately to the past. Such reports stimulate a further search for the utilisation of electrical power in preference to steam. Even the motor power of electrical works is replaced by water power. Heretofore this has been chiefly effected by the natural water power of rivers. Recently new endeavours had been made similarly to utilise the motion of the tide. In Hamburg a company has been started, styled the "Wasserkraft Anlage," to work a new electrical plant with the aid of the tide. The works are to supply Cuxhaven with electric light and to run an electric railway. According to present calculation, the electric current ought to be supplied at a greatly reduced price. The experiment, which is protected by various patents, is followed with the keenest interest.

The Austrian Consul at Stuttgart reports that in the electro-technical industry in 1907 conditions were satisfactory until the middle of the year. The productions (magneto-electric firing apparatus for motor-bicycles, automobiles and fixed motors) found an increasing sale both at home and abroad until in the second half of the year things came to a standstill as a result of the general commercial depression. In order to avoid over-production in consequence of this falling off in demand, it was found necessary to dismiss workmen towards the end of the year.

Russia.—The Austrian Consul at Odessa, in a recent report, states that the electro-technical industry of Russia has been developed only to a small extent. In spite of the increased import duties on electro-technical goods no new undertakings were started in the Odessa district in 1907. The existing industry confined itself as formerly to the production of motors and machines of the rougher type and cables and wires. A part of the telegraph and telephone apparatus used in Russia is also manufactured by the home industry. All the finer measuring instruments, armatures for lighting purposes, and arc lamps and carbons, are imported from abroad and chiefly

from Germany. A part of the trade in incandescent lamps is taken by Hungary. Factories which manufacture dynamo machines exist in Petersburg, Riga and Moscow, cable and wire factories in Petersburg, Moscow and Kiev, an incandescent lamp factory in Warsaw, an arc lamp carbon factory in Moscow, and a factory for accumulators in Petersburg; a small factory of the latter kind also exists in Odessa. The utilisation of electric energy in Russia showed a considerable increase in 1907 in continuation of the increase consistently shown in recent years. In most of the factories and mills electric lighting is installed, and in some electrically-driven machinery. In many towns, for example, Cherson, Simferopol, Sevastopol, and Nikoliev, new electrical works have either been erected or old works have been extended.

United States.—The Austrian Consul at Chicago reports that the extraordinary development of the electro-technical industry continued until the commercial crisis of 1907, when a severe check in the expansion was experienced. Nevertheless, the value of electro-technical goods produced in 1907 increased from $20,000,000 to $21,800,000, or an increase of 12 per cent., and the sales increased by 15 per cent., *i.e.*, from $17,250,000 to $19,000,000, In the telephone section of the industry, backward motion set in in the second half of 1907, whereas in the first half of the year all previous records in production had been broken. An important local event was the fusion of Chicago Edison and the Commonwealth Electric Co. under the firm Commonwealth Edison Co.; later on considerable reductions were made in the rates for energy for lighting and power purposes, making Chicago in this respect one of the cheapest towns in the States. The result on the part of the public was a considerable increase in the utilisation of electric light and power, which increased by 35 per cent., as compared with the previous year, which had itself constituted a record.

Norway.—The German Consul at Drontheim, in a recent report, states that the utilisation of electrical energy in that town has increased to such an extent that the present works at Lerforsen have become too small to cope with the demand. A sum of 1,500,000 kronen has consequently been voted for the extension of these works whereby it is hoped to double the available horse-power which it is anticipated will provide for the supply of all needs for the next 10 years.

France.—The British Vice-Consul at Limoges, in a recent report, states that the construction of electric railways in the Department of Haute Vienne, has been approved, and contracts will soon be open to tenderers, who must be French, but who will be authorised to import foreign machinery.

Society Islands.—The British Consul at Tahiti, in a recent report, states that among the innovations in agriculture to which the soil of some of the uninhabited valley lands of Tahiti and of other neighbouring islands would be propitious, is the planting of rubber, which it is believed, would give excellent results. The variety which appears to be specially recommended for the valleys of Tahiti, is the Castilloa elastica, which has been experimented upon on a small scale with such encouraging results that a local company has been floated for the purpose of planting rubber on an extensive scale. The appeal for local capital, however, has not so far received much palpable support, not from want of confidence in the scheme so much as from lack of funds which, in a scheme of this kind, would be tied up for about eight years before they could bear the fruits of the investment. Rubber, however, is destined, it would seem, sooner or later to play an important part in the exports from these islands.

Spain.—The British Vice-Consul at Almeria reports that a station for wireless telegraphy has recently been erected on the highest point of the Alcazaba, the old Moorish castle, overlooking the port, for the purpose of communicating with Melilla, on the African coast. This station has been erected by order of the Ministry of War, and will only be used by that department. It is stated that it will be working in the course of a month or two.

The British Vice-Consul at Carthagena reports that on the urban and suburban tramways of that town, the change from animal to electric traction has been effected, causing a great increase in the number of passengers.

Mexico.—The British Vice-Consul at Monterrey, in a recent report, states that in 1907 the electric street car system was practically completed. The work has been carried out by a Canadian firm.

Ediswan Fire Brigade.—We learn that in the competition held at Leyton on Bank Holiday the Ediswan Fire Brigade were successful in winning the fourth prize in the one man manual drill, also first prize in the five men manual drill. They also tied with Wanstead Fire Brigade for the "Vincent Challenge Shield," but lost this in the re-drill. The "Vincent Challenge Shield" is held for one year by the brigade making the fastest time in the two men and five men drills.

Bankruptcy Proceedings.—*Re* William Terrell Garnett, electric cable wire manufacturer (trading at Barkerend Mills, Bradford, as W. T. Garnett's Cable Co.).—In this matter a summary of the statement of affairs has been issued, which shows the gross liabilities to be £94,942, and liabilities expected to rank for dividend amounting to £31,330. The assets, after deducting preferential creditors, are estimated to produce £8,129, leaving a deficiency of £23,201. The stock-in-trade, which cost £4,302, is valued at £2,868. The debtor attributes his failure to depreciation in the value of real estate, heavy bank charges, unsuccessful trading owing to the Eastern crisis, fluctuation in the price of copper, losses on investments, and the initial expenses of certain businesses. In accounting for his deficiency, he puts down depreciation in value of cable and other machinery as estimated for realisation £2,532, whilst another very large item is interest on bank overdraft and loans £8,787, and law expenses re bank overdraft £329. The debtor began business in 1888 as a worsted spinner, he then becoming entitled to a half share of his father's real and personal estate, which was valued at £240,000. He lost money heavily in this and other businesses, and in September, 1902, began his present business as an electric cable and wire manufacturer. This business has proved a failure, owing mainly to loss on contracts and a heavy fall in the price of copper. There was a loss on the trading for the 13 months preceding March 31st last of £8,000. From June, 1904, until February 14th last, the debtor had a partner in this business, but the partner introduced no capital, and when the partnership was dissolved he retired without receiving any payment. Heavy losses have also been incurred in connection with investments in limited companies, and the debtor filed his petition because certain creditors insisted upon bankruptcy. The creditors for sums over £10 are as follow:—

	£
Ancoats Vale Rubber Co. Manchester	270
Associated Battery Co., London	14
Bradford Bobbin Co., Bradford	19
Boldy & Son, Bradford	14
Beecroft & Wightman, Bradford	23
Britannia Rubber Co., London	35
Clark, Sons & Co., Manchester	20
Cresswell's Asbestos Co., Bradford	27
I. Frankenburg & Sons, Manchester	123
Goessmann & Co., Crefeld	11
L. N. Greenbaum & Sons, London	180
R. R. Griffin, Bradford	60
J. H. Holdsworth, Bradford	30
Harrison Bros., Sheffield	40
W. Hinder, Bradford	30
T. Lamuch & Co., Manchester	10
G. W. Laughton & Co., Preston	179
McConnell & Co., Ltd., Manchester	267
Martin's Steel Metal Co., Birmingham	29
J. Maggrove & Co., Ltd., London	41
D. McDougall jun., & Co., Glasgow	21
Pearsall & Co., London	39
T. Paton & Co., Bradford	70
Ramsden, Camm & Co., Brighouse	200
F. W. Richardon & A. Jaff	12
Rones, Ltd., Leeds	15
F. Smith & Co., Salford	472
Stephenson Bros., Bradford	16
J. Slater & Co., London	256
A. Thornton Son & Co., Brighouse	168
Taylor, Jeffery & Jessop, Bradford	68
United Asbestos Co., London	582
S. W. Whaley & Co,, Bradford	295
C J. Garnett, Hereford	2,805

James Allan Welsh, electrical engineer and mill furnisher, Kilmarnock, has been examined in bankruptcy at Kilmarnock Sheriff Court. The state of affairs showed assets £310, and liabilities £2,450. Bankrupt explained that he started business about five years ago with obligations for borrowed money to the extent of £400 or £500, and stated that about £800 had never been in the business proper, but had been borrowed to pay accommodation bills. There were about £200 for bad debts. He believed he lost a good deal by leaving the mill furnishing business alone and trying to develop the electrical business, which never paid him, and his average earnings from the business were £293 per annum, and his excess over the earnings for the whole period was £822 odd. There was £674 accounted for by the difference between the valuation which had been made in the bankruptcy and his own valuation of the stock.

Trade Announcements.—Mr. Harold W. Dangerfield is continuing his business as a code expert at 143, Cannon Street, E.C., his agreement with the Pantelegraphy Publishing Co., Ltd. (in liquidation) having terminated.

Mr. Harry Nance, 4, Church Street, Cardiff, informs us he is now representing the following firms in South Wales and West of England:—Arc Lamps, Ltd. (St. Albans). Pritchetts & Gold, Ltd. (London). Newtons Ltd. (Taunton). Ward & Goldstone (Manchester). Fuller, Electrical Co. (London). Nalder Bros. & Thompson, Ltd. (London). Birmingham Lighting Co. (Birmingham). Wm. Wadsworth & Sons (Bolton). He also keeps a stock of Messrs. Ward & Goldstone's electrical supplies, &c.

Messrs. Kelvin & James White, Ltd., of Glasgow, have notified us that, in future, their London office address will be Kelvin & James White, Ltd., Electrical Department, 11, Billiter Street, E.C.

Messrs. Charlesworth, Peebles & Co., of 53, Bothwell Street, Glasgow, have been appointed as sole selling agents for Glasgow and the West of Scotland of Messrs. Bruce Peebles & Co., Ltd., East Pilton, Edinburgh.

Catalogues and Lists.—Messrs. A. P. Lundberg and Son, 477—487, Liverpool Road, London, N.—Advance proof of 8-pp. pamphlet, giving, in their standard form, particulars and prices, with illustrations and diagrams of connections, of various new types of ceiling roses.

Messrs. Shippey Bros., 13 and 14, King Street, Cheapside, E.C.—Pamphlet relating to their chemical decarboniser for cleaning motor-car engines, &c.

Union Electric Co., Ltd., London, S.E.—List 8,012, describing and giving prices of their contact voltmeters, relays, signal bells and lamps for D.C. and A.C. circuits.

Walsall Electrical Co., Ltd., 57, Bridge Street, Walsall.—Attractively got up brochure in which they give some interesting notes on the subject of country house lighting, with capital half-tone views of a number of such mansions where they have put down isolated installations.

The India Rubber, Gutta Percha, and Telegraph Works Co., Ltd., Silvertown.—Twenty-four page revised price list of various classes of insulators, fittings, and tools, for telegraph and telephone lines.

Messrs. Joseph Shaw & Son, Ltd., Albert Brass Works, Huddersfield.—Fifty-six page catalogue of their steam specialities, including their various stop and slide valves and feed and check valves, in which a number of improvements are embodied, also water guages, gauge protectors, water level indicators, steam traps, lubricators, &c The list is fully illustrated, and prices are given.

Messrs. Siemens Bros. & Co., Ltd., Broadway, Westminster, S.W.—Catalogue No. 510, comprising some 54 pages, setting out full particulars of a variety of cable accessories. It is got up in the firm's usual admirable style, and is punched for filing with previously issued publications. A wire gauge table, a British standard

table of conductors, and other useful tables of a similar character lead the way, and the various sections which follow respectively detail, and state prices of, jointing materials, tools and cable-laying appliances, testing instruments, and dry cells.

Messrs. Turners & Manville, Ltd., 5, Lloyd's Avenue, London, E.C.—Small pamphlet relating to their asbestos wood which is intended to take the place of slate and marble in electrical construction. It is claimed to have a very high fire resistance, and is made up into arc shields, controller linings, &c. The insulation of the black wood is claimed to be equal to hard rubber, or sheet mica, and the breakdown voltage on ⅛ in. thick is said to be 22,000 volts. The white wood is of slightly lower insulation, and is supplied for general fire-proof construction work. Copies of the pamphlet may be obtained on application.

Messrs. Simplex Conduits, Ltd., Birmingham and London.—Twelve page catalogue (Section W) giving tabulated sizes, prices, &c., of the firm's wires and cables, flexible cords, bell wires, telephone cables, &c. Also a "Progress" sheet giving prices of distribution boards, switch blocks, &c.

General Electric Co., Ltd., Queen Victoria Street, E.C.—Quite a novel and effective "Osram" showcard has been issued by this company. It is made of a convenient size for shop-windows and showrooms, and has a gauze backing rendering it equally suitable for a dark background or a window pane, the letters "Osram Lamps" standing out boldly in either case. We have also received a leaflet reprinting a number of testimonials given by "Osram" users, showing a striking economy of consumption as reflected in the amount of their quarterly bills. A loose leaflet from the same company illustrates and prices the Archer electric cooking outfit; figures are given to show that the cost of cooking a dinner for about six or eight people is 4½d., reckoning at 1d. per unit.

British Insulated and Helsby Cables, Ltd., Prescot.—Leaflet No. P77 showing the Prescot N.F. (non-fouling) trolley wire fitted with a straight line mechanical ear, and setting forth the advantages thereof.

Messrs. Falk, Stadelmann & Co., Farringdon Road, E.C.—Striking coloured poster, showing the "Sirius Efesca" metal filament lamp, and prominently announcing that it saves 70 per cent. in current. Copies of the poster—which does not bear the firm's name—can be obtained by any electrical contractor or trader on application.

Dissolutions and Liquidations.—Electrical Instrument Manufacturers, Ltd.—A petition for the winding up of this company presented by Gordon & Gotch, advertising agents, is to be heard at Edmonton on September 14th.

Private Telephone Co., Ltd.—This company is winding up voluntarily with Mr. G. Hollingum, Rosefield, St. Wilfrid's Road, New Barnet, as liquidator. A meeting of creditors was to be held on August 26th.

Blackpool Electric Tramways (South), Ltd.—Creditors must send particulars of their debts, &c., to the liquidators (Messrs. Gowan and McWilliam, 43, Castle Street, Liverpool) by October 5th.

Hill, Upton & Co., electrical engineers, 22, George Street, Oxford and Banbury.—Messrs. W. T. Upton and J. E. Elliott have dissolved partnership. Mr. Upton will attend to debts and carry on the business.

The *Edinburgh Gazette* announces that the co-partnership of Rogers and Harris, electrical and consulting engineers, 10, Gardner Street, Glasgow, has been dissolved by mutual consent. Mr. Joseph Harris will, however, continue the business in his own name, and will discharge all the liabilities of the firm.

Messrs. Sanfil, Ltd.—A meeting is to be held at Watergate House, Adelphi, S.W., on September 30th, to hear an account of the winding up from the liquidator, Mr. F. S. Tomkins.

Messrs. Bergtheil & Young, Ltd., are anxious to dispel an impression that has got abroad that they are in liquidation. The misunderstanding seems to be due to a notice of the final meeting of the old company (Bergtheil & Young, Ltd., 1904), which recently appeared in the *London Gazette*. The notice, of course, did not concern the present company, which is continuing as usual.

LIGHTING and POWER NOTES.

Aylesbury.—The R.D.C. has received from the Chesham E.L. Co. an intimation that it is applying for a prov. order for electric lighting.

Barnstaple.—The Lighting Committee met on the 19th inst., when the engineer submitted a report as to adopting a system of two-rate meters for large consumers of over 2,000 units for lighting purposes during 12 months. Energy consumed between 6 p.m. and 11 p.m. will be charged at 4½d. per unit, and between 11 p.m. and 6 a.m. the charge will be 2¾d. per unit; no discounts will be allowed to such consumers. The report was adopted.

Berwick-upon-Tweed.—The Urban Electric Supply Co., Ltd., has applied to the B of T. for permission to use overhead electric lines from the Old Quarry to Seaview Works, Spittal.

Brighouse.—The T.C. recently applied for loans of £3,624 and £3,940 for electricity purposes. The L.G.B. has refused sanction to the former loan, which, it is stated, was required to pay for plant purchased some years ago from a private concern, and further, asks for more information before granting the latter loan, which is required for the erection of a transforming station in connection with a bulk supply from the Yorkshire Electric Power Co.

Chichester.—The B.G. has requested the E.L. Co. to submit a report as to the cost of wiring the workhouse for the electric light.

Continental Notes.—Italy.—La Societa Cotonificio Staurenghi has secured a concession from the authorities of the Province of Turin, to put down a plant to utilise the water power of the River Evancon, at Challant St. Victor, in the generation of electrical energy for power purposes at its textile mills.

Dartford.—At the last meeting of the U.D.C., Mr. Wooller moved that the General Purposes Committee be instructed to go into the matter of street lighting, and bring up a scheme for the reduction of the yearly expenditure of £1,868, or about £5 per electric lamp. In reply to a question, the electrical engineer said he did not agree with the statement that the electric lamps cost £5 per annum each, and Mr. Putland pointed out that of the £1,868 between £250 and £300 was for lamp columns, &c. The resolution, in the result, was negatived.

Devonport.—The electric revolving crane at No. 2 Jetty, South Yard, has been subjected to a series of trials to test its efficiency prior to acceptance from the contractors, Messrs. Marshall & Fleming. This crane is the first of its type to be erected at Devonport, and is designed to lift loads up to 30 cwt., the motive power being obtained from a single electric motor of the Westinghouse type. The mechanism is arranged to lift the full working load of 30 cwt. 50 ft. in one minute.

Dublin.—The Corporation has agreed to apply to the L.G.B. for sanction to a further loan for extensions. The sum of £69,706 is estimated as required principally for extending the distributing network, but it also includes £10,000 for meters and services.

At the special meeting of the Corporation a recommendation that a tender of Messrs. Babcock & Wilcox should be accepted, elicited the fact that it had been amended since being first received, and it was resolved that fresh tenders should be advertised for.

Dunfermline.—At last the T.C. has got rid of the electric lighting problem which has troubled it for two years past, the final act being the adoption of the draft agreement with the Fife Electric Power Co., to whom the Corporation's prov. order is now transferred. A letter was read from the agents of the company, stating that the latter was applying for a prov. order, but assuring the Council that this was not intended to interfere with the course of the negotiations. After the vote adopting the agreement, several councillors were heard to murmur prayers of thankfulness that the matter was now at an end.

Greenock.—At the weekly meeting of the T.C., the annual accounts of the Electricity Committee were submitted by Bailie Shankland, who pointed out that the actual profit on the year's working was not so large as upon two previous occasions. However, the result, which showed an increase of 41 per cent. in the output to private consumers, might be considered thoroughly satisfactory. The returns from private lighting and power showed an increase from £13,091 to £16,874. After payment of working expenses, the gross profit amounted to 6·3 per cent. on the capital employed during the year, the net balance on the year's working being £384, which, with £286 from the previous year, brought the credit balance to £670. With regard to the estimates for the current year, a net balance of fully £1,300 was anticipated.

Kingston-on-Thames.—A L.G.B. inquiry was held on August 19th with reference to an application by the T.C. to borrow £12,600 for the electricity undertaking. Amongst the items making up the total were the following:—£1,150 engine room works, £2,898 mains, £2,850 services, £1,890 transformer kiosks, £340 transformer sub-stations, £600 high and low-tension disconnecting pillars, £300 arc lighting, £264 incandescent lighting. Mr. J. E. Edgcome, electrical engineer, said there were 100 incandescent street lamps now installed, and it was proposed to install an additional 200. The annual cost of the incandescent gas street lamps was £3 8s. 6d., including painting, and the Council credited the undertaking with a similar sum for each incandescent electric lamp, which price, he believed, covered the cost as it worked out at 2d. per unit. The arc lamps were charged for at £20 per annum each. In the course of the inquiry it was stated that there was a deficiency last year of £884. The undertaking was established in 1894, and the deficit up to the present was £10,739. In reply to the Inspector, Mr. Edgcome said the present loss was due primarily to the great increase of the price of coal, and also to reductions in the charges for current. The Inspector: Were you justified in making the reductions?—Mr. Edgcome: We could get nobody to take current for power at 3d., and I think we have justified the 1½d. price by the increased day load.

Littleborough.—The U.D.C. has appointed a deputation to discuss with Rochdale Electricity Committee terms for the supply of current in bulk, the Littleborough Council being desirous of retaining its electric light order.

Loughborough.—The T.C., with a view to demonstrating the advantages of electric power, is prepared to install a motor temporarily for one day for driving machinery, in order that manufacturers may arrive at the comparative cost compared with present methods.

Mansfield.—The T.C. has applied to the L.G.B. for a loan of £2,500 for mains, and £500 for meters.

North Stoneham.—The P.C. has informed the R.D.C. that it objects to the proposed E.L. scheme for which a prov. order is being applied for by Southampton T.C.

Perth.—A fairly satisfactory year has been experienced by the electrical department, which ended the year with a credit balance of £401. The estimates for the current year have been formed on a conservative basis, the estimated revenue being £7,864, or a decrease of £192, as compared with last year. The estimated expenditure is £4,946, being £196 more than last year. Special facilities are to be given to shop-keepers and others, and a general reduction of charges is promised.

Portpatrick.—The turbine and engine houses belonging to Portpatrick Electric Supply Co,, and situated at Craigoch Dam, about a mile from Portpatrick, have been destroyed by fire. An oil engine was recently introduced to supplement the water power. Two workmen were on the premises when the fire broke out in the engine room; one of these was hemmed in by the fire, and received cuts and burns on the hands and face before getting outside.

Ross (Herefordshire).—The R.D.C. has decided to consent to the application of the Ross E.L. Co. for a prov. order for electric light in the Council's area.

Rossendale.—The Rawtenstall T.C. has received a letter from the town clerk of Bacup confirming the arrangement made at the recent L.G.B. conference, that the Corporation of Bacup will forego the supplying of electricity to the Bacup tramways (*i.e.*, those tramways which are to be worked by the Rawtenstall Corporation), and the Rawtenstall Corporation will, if and when required so to do by the Bacup Corporation, supply energy for lighting and power purposes (exclusive of the above-named tramways) at a price to be mutually agreed upon, and in arranging such price, the whole of the current supplied and used in Bacup by the Rawtenstall Corporation is to be taken into consideration. Failing agreement as to price, the same is to be settled by arbitration. The arrangement is subject to the confirmation of the Bacup T.C. and to the sanction of the L.G.B. being given to the application of the Rawtenstall Corporation for sanction to a loan for a municipal supply station in the Borough of Rawtenstall.

It has been resolved by the Rawtenstall T.C. that the following final offers with respect to the supply of electricity to the Haslingden Union Workhouse for lighting and power purposes be made: To supply it with electricity (subject to a five-years' agreement) for lighting purposes at 3¾d. per unit for the first 15,000 units and a flat rate of 3d. per unit for all additional units; the minimum supply to be taken being 15,000 units per annum; provided it accepts the above tender, to supply it with electricity for power purposes at 1½d. per unit without fixing a minimum supply for power purposes.

Shildon.—The U.D.C. has accepted the tender of the Northern Counties Electricity Supply Co. for public lighting.

Southend-on-Sea.—The T.C. has decided to supply energy for power at the following rates:—April to September, 6 a.m. to 7 p.m., 1½d. per unit; 7 p.m. to 6 a.m., 6d. October to March, 6 a.m. to 6 p.m., 1½d.; 6 p.m. to 6 a.m., 6d. The existing flat rate of 2d. remains.

Stirling.—The T.C. is applying to the Secretary for Scotland for powers to borrow £3,000 additional capital in connection with the extension of the electric light undertaking. A new feeder cable is required for the Shore Road district. The money will be expended during the next three years.

Sunderland.—A special meeting of the E.L. Committee has been held to discuss the grievances of the sub-station staff; the men are members of the Gasworkers' and General Labourers' Union, which body has taken the matter up, and it is understood that amicable arrangements have been arrived at.

Todmorden.—The receipts in the electricity department during the past year show a gratifying increase. Last year they were £736; this year they were £1,173; while the working expenses have only increased from £860 to £890. The sinking fund and interest charges show a slight increase on last year, but the deficiency on the department shows a reduction from £1,452 last year to £1,159. The loan capital stands at £18,237, against £19,037 last year.

West Hartlepool.—During the last year's operation of the electricity works, the output increased to 1,756,854 units, and the cost of production declined to 1·05d. per unit. The supply for power purposes has more than doubled during the past two years.

Workington.—The E.L. Order, 1901, as confirmed by the E.L. Orders (No. 5) Act, 1901, as to the whole of the area of supply, has been revoked by the B. of T.

TRAMWAY and RAILWAY NOTES.

Dundee.—The work of extending the city tramways from High Street to the West and Tay Bridge stations and to Craig Pier has commenced. The undertaking will be carried out by Corporation labour.

Glasgow.—The T.C. Committee on Extensions has for some time had under consideration the advisability of extending the Corporation tramways from Baillieston to Coatbridge. A report regarding an inspection of the proposed route, and of a conference with the T.C. of Coatbridge, has been considered, and the Committee has now recommended that the proposed extension be delayed and not included in the next provisional order. The Committeee also recommended that the proposed extension to Bellshill be not considered by the T.C.

The question of the delay which will take place, on account of the engineers' strike, in the completion of the contract between the Corporation and Messrs. Richardsons, Westgarth & Co., for a turbo-alternator for Pinkston power station, has been under consideration.

Haslingden.—The minutes adopted by the Council on August 20th contained the following resolution passed in committee:—"That application be made to the B. of T. to borrow the sum of £7,200 for the purpose of providing the necessary machinery, &c., required to provide electrical power to work the tramways in this borough." The only question now to be settled is the building, and the L.G.B. is reviewing the situation.

Huddersfield.—It is proposed to extend the tramway system from Stile Common to Newsome Church.

Extensions are being carried out at the Great Northern Street depôt so as to provide accommodation for the storage of all the cars.

Hythe.—At a meeting on Thursday last week it was decided to take the opinion of the ratepayers on the proposal of the company to alter the tramway route and system.

Lincoln.—It is stated that a scheme to build an electric railway, partly in tube form, up the Steep Hill, Lincoln, is being matured. The length of route will be 1,000 ft. and the rise 142 ft. The City Sheriff (Mr. W. R. Lilly) appears to be the moving spirit, and he has purchased property and secured rights and easements with a view to constructing the line, which he desires shall belong to the city.

Liverpool.—A somewhat serious tramway accident occurred on the 20th on the Brickfield Road, North Docks route, where a car left the track at a corner and fell over on to a loaded wagon. Nine injured passengers were treated in hospital, while the driver was seriously injured, he being pinned to the front of the car for half-an-hour.

In explanation of the occurrence, the driver (Richard Walsh) states that he commenced to descend Lambert Road at a low rate of speed on the electric brake, and brought the car in perfect safety to the bottom of the hill, where it was necessary to put on the hand-brake to hold the car stationary at the compulsory stop. In doing so he failed to engage the clutch at the bottom of the brake staff, with the result that on starting, the hand-brake flew off and the staff struck him a heavy blow on the elbow, disabling himself for the moment, and thus allowing the car to go without the brake for a distance of 18 or 20 yards, where it collided with a wagon, thus causing the accident.

London.—It is understood that as the result of prolonged negotiations between the Battersea B.C. and the L.C.C. all difficulties in the way of the electrification of the remaining horsed tramways in Battersea and Wandsworth have been practically removed. In regard to the Queen's Road and Chelsea Bridge Road a financial agreement has been come to, and the work will be proceeded with at once. As to the line from St. John's Hill to Vauxhall, a tentative agreement has also been arrived at, subject to confirmation by the B.C. at its meeting in September and the L.C.C. when it reassembles. Both lines will be on the conduit system, but in Queen's Road, owing to the very low railway bridges, only single-deck cars can be used.

Manchester.—It is not improbable that the Tramways Committee will decide to make a trial of the trackless trolley system in one or more of the outlying suburbs. A deputation, which embraced the chairman and two other members of the Committee, together with Mr. McElroy, the general manager, have been to Germany to inspect the working of the system there. What their conclusions may be has not yet transpired. They will present a report to the Committee at an early date. It is understood that the deputation were favourably impressed. A system which obviates the necessity for tram lines would not only, it is thought, prove economical in itself, but would also render unnecessary a large expenditure on road widening. One of the first routes on which it would be tried would probably be between Sale and Palatine Road, *vid* Northenden, for which the Manchester Corporation already holds Parlimentary powers.

Nottingham.—An unusual accident took place on a car on Saturday, 15th inst., when a descending passenger, who gripped the stair rod, received so severe a shock as to necessitate his removal to, and detention in, hospital for some days.

Todmorden.—The traffic receipts for the year in connection with the motor omnibuses amounted to £2,719, and made with income from advertisements £2,834. The working expenses were £4,928, and sinking fund and interest charges, £969, making a total deficit for the year of £3,063.

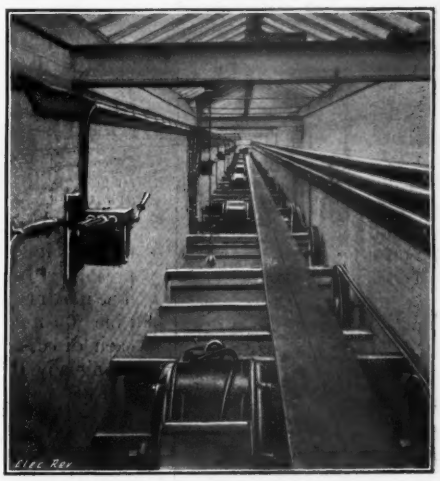
Torquay.—Mr. W. H. Mills, on behalf of the Torquay Tramway Co., has intimated to the Paignton Council that the company is prepared to proceed with the Paignton extension in the next session of Parliament, and has inquired as to the route and necessary widenings. The Council has deferred the matter pending further information from the company.

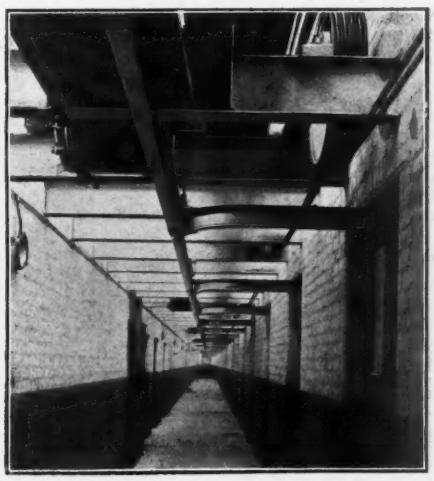
Victoria (Aus.)—According to latest reports, it is believed that Mr. C. H. Merz, consulting engineer to the Victorian Railway Commissioners, will include in his electrification scheme, the Essendon and Brighton routes in addition to the St. Kilda and Port Melbourne lines, giving a route mileage of about 20. It is understood that third rail construction will be adopted.

ELECTRICITY IN THE "PREMIER" MILL.

The Premier mill is situated in the Tame Valley, Stalybridge, and in more respects than one may justly lay claim to the name given it.

The mill is constructed on modern lines, being built entirely on the shed principle, with no upper storeys, and with the result that the cotton, as it passes through the various processes, is readily handled until it leaves the mill in the form of finished cloth. This arrangement has been made possible by the utilisation of the electric drive, which we here propose to particularly describe.





Figs. 1 and 2.—Views showing Method of Coupling Motors up to Cross Shafts in Weaving Shed.

Three-phase energy is furnished direct from the Stalybridge, Hyde, Mossley and Dukinfield Joint Board's main generating station, being transmitted at a pressure of 6,000 volts to the mill, where it is reduced by means of three 250-kw. Westinghouse transformers to 400 volts, and distributed to the motors in the mill at this pressure, the control of the various circuits, as well as of the transformers already mentioned, being carried out by means of a Ferranti switchboard.

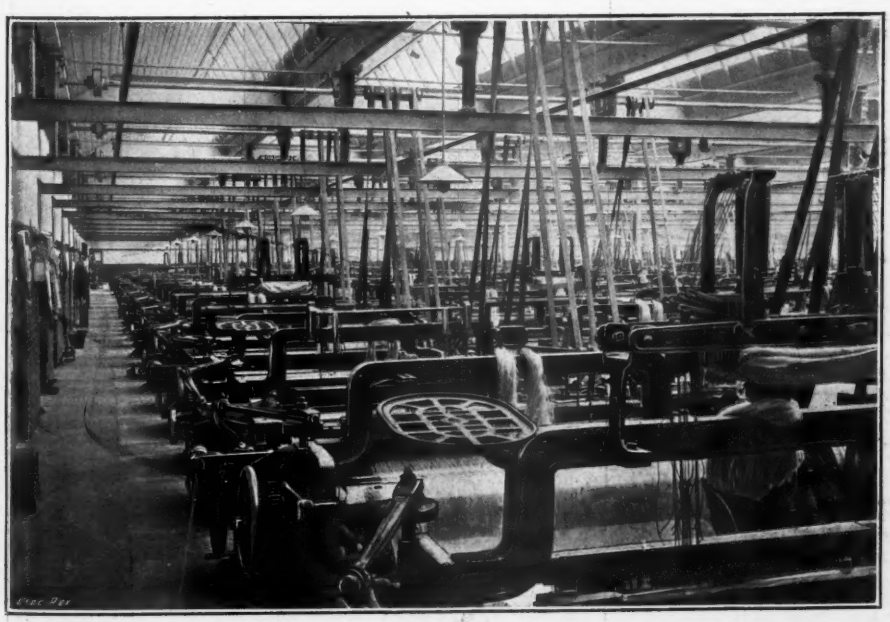


Fig. 3.—Interior of Weaving Shed, showing High-Speed Cross Shafting.

The motors are of the induction type, and wherever the conditions will permit, a squirrel-cage rotor is employed. This is the case in all instances except the two 150-h.p. motors operating ring spinning frames, and the 80-h.p. machine driving the slubbing and roving frames, which are of the slip-ring type. The former type, of course, offers great advantage in that there are no rubbing contacts or parts whatever between the rotor and the stator other than the journals, whereas, with the latter, current has to be collected from the rotating part by means of brushes bearing on rings, these brushes and rings being entirely enclosed, as shown on the motor seen on fig. 8, while fig. 5 shows a similar machine, but with the cover removed.

Fig. 8 shows a portion of the blowing room. The 40-h.p. squirrel-cage machine seen at the extreme right drives the machinery in this room as well as the bale breaker and lattice, which are in an adjacent room. The 80-h.p. slip-ring motor is direct connected to the line shaft running at 580 r.p.m. seen in fig. 4, from which the slubbing and roving frames are driven by means of half-cross belts, this high-speed shafting permitting of the use of pulleys of approximately the same diameter on the shaft and frame, with the result that an excellent drive is obtained.

The carding machines and drawing frames, seen in the

F

view last mentioned, are driven in a somewhat similar manner from the 60-H.P. squirrel-cage motor shown on fig. 8 at the left.

The ring room is operated by two 150-H.P. slip-ring motors running at 570 R.P.M., and direct connected to the line shafts. One of these motors with the slip-ring cover removed is shown on fig. 5; the main switchboard is also seen at the lower part of this view.

FIG. 4.—SLUBBING AND ROVING FRAMES (ON THE LEFT), OPERATED FROM LINE SHAFT DIRECT COUPLED TO 80-H.P. WESTINGHOUSE MOTOR; CARDING MACHINES ON THE RIGHT.

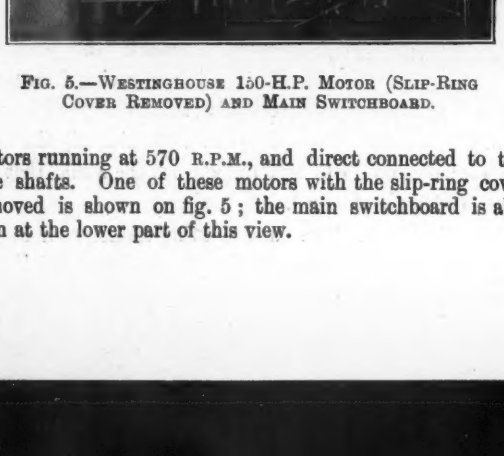


FIG. 5.—WESTINGHOUSE 150-H.P. MOTOR (SLIP-RING COVER REMOVED) AND MAIN SWITCHBOARD.

Figs. 6 and 7 show 7½-H.P. and 15-H.P. squirrel-cage motors running at 580 R.P.M., driving winding frames and sizing machines respectively. These motors carry reduction gear, which is entirely enclosed, the second motion shaft being directly coupled to the line shaft.

The driving of the weaving shed presents one or two unique features, direct connection of the motor to the cross-shafts being adopted, and necessitating—since the motors run at 570 R.P.M.—quite small pulleys on the shafts, to get the desired speed on the driving pulleys of the looms.

Figs. 1 and 2 show the motor alley, the motors being carried on girders from side to side, as seen on fig. 2, which is a view taken below the machines. It may be noticed that this alley constitutes the main passage in the mill, and consequently no useful space is occupied by the motors. This view also shows the overhead railway for carrying the warp beams from the preparing side to the weaving shed. The motors driving the shafting comprise nine 60-H.P. squirrel cage machines, each direct-connected to one cross-shaft as already stated, on which is carried a rope pulley which drives two other cross-shafts at the same speed, one to the right and one to the left. The steadiness of these drives can well be appreciated from the views, when it is pointed out that the photographs from which they were made were taken while the mill was running.

Fig. 3 shows the general appearance of the weaving shed, the motors being outside the wall shown on the left.

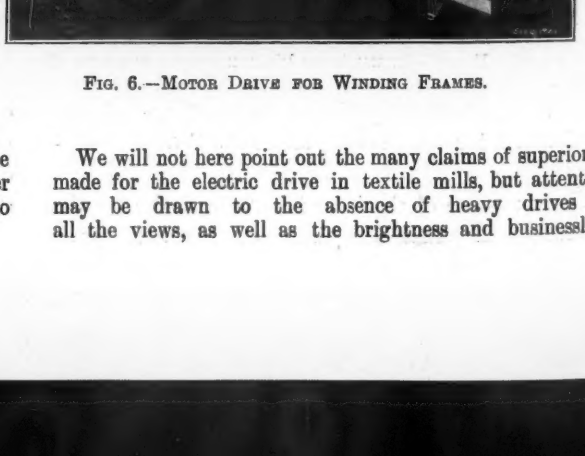


FIG. 6.—MOTOR DRIVE FOR WINDING FRAMES.

We will not here point out the many claims of superiority made for the electric drive in textile mills, but attention may be drawn to the absence of heavy drives in all the views, as well as the brightness and businesslike

appearance of the mill and the fact that no floor space whatever is occupied by the driving machinery.

As already pointed out, energy is procured from the Stalybridge, Hyde, Mossley and Dukinfield Joint Board's generating station, the chief engineer and manager of which, Mr. Robert Blackmore, A.M.I.E.E., is the consulting engineer to the Premier Mill Co., and as such was responsible for the plans and specification to which the electrical equipment of this mill was carried out, as well as for the execution of the work. The mill is electrically lighted throughout, this work having been carried out by Messrs. E. M. Evans & Co., of Manchester.

All the motors with their starters, &c., were supplied by the British Westinghouse Co., while the wiring work in connection with these was carried out by Messrs. L. E. Wilson and Co., of Manchester.

COLLIERY CABLE PRACTICE.

By D. A.

The few remarks given below are submitted by the writer in the hope that they will be of interest to the colliery electrician, who being generally a hard-worked individual whose scope covers a wide field, does not always give his distribution system the assiduous attention that it deserves. When one considers that an important colliery may have in use some 40 miles of cable at pressures of from 6,000 volts down to 500 volts, supplying current to every class of mining machinery, and the enormous strides the application of electricity has assumed of recent years, coupled with its undoubted growth in the future, does it not merit the greatest thought being given to the whole of the cable system, upon the successful installation and operation of which so much depends?

Mining conditions are so essentially unique that the writer feels that the subject is worthy of ventilation by those who are in touch with such work.

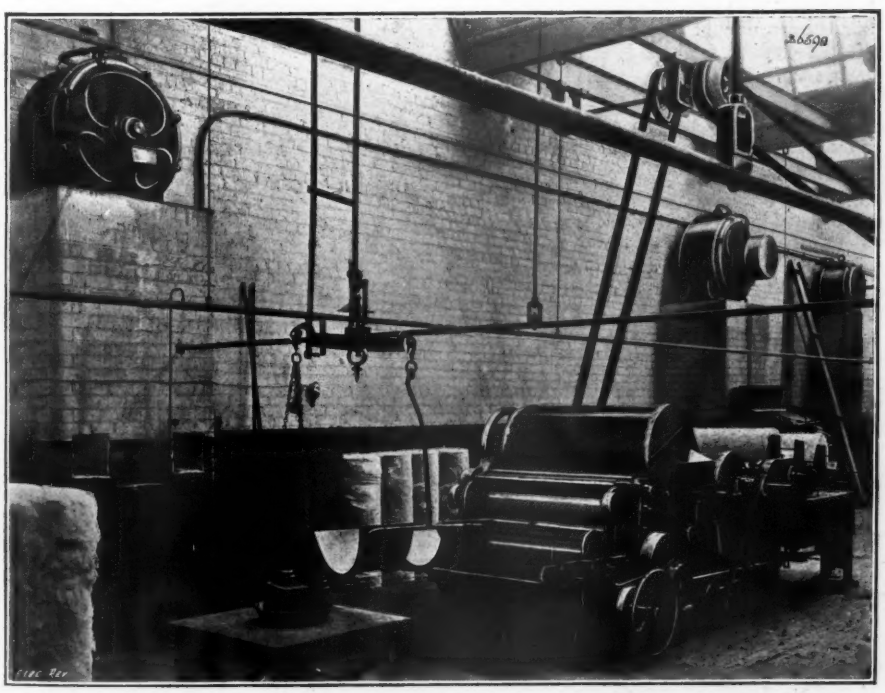


Fig. 8.—A Portion of the Blowing Room, showing Westinghouse Squirrel-Cage and Slip-Ring Motors.

It is not so much the sectional area of the cables that is of great moment, as it is more usual to err on the generous side, and lay down feeders of ample carrying capacity, but there is ample scope for judgment in the selection of cables and in their subsequent installing.

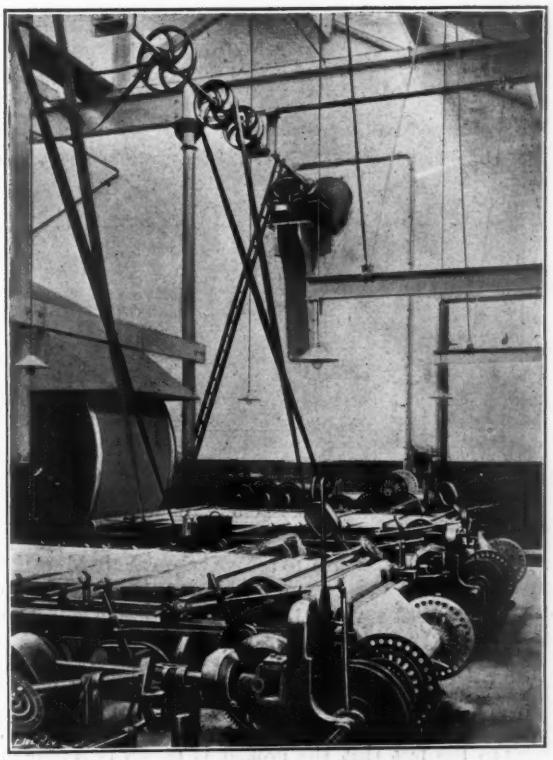


Fig. 7.—Sizing Machines, Operated from Geared Motor.

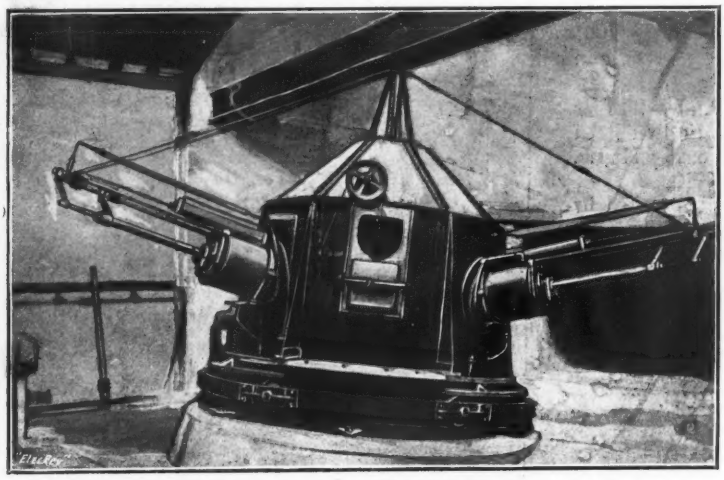
Shaft feeders must of necessity be strongly constructed and amply stayed, a bitumen cable being wholly unable to carry its own weight without damage. The best practice in the author's opinion is to use double-armoured, lead-covered, paper-insulated cables, the armour to be well treated with a tarry composition to counteract the chemical action of impure water.

The majority of the distributors should be "leadless," preferably a good quality bitumen cable, and as they will have to bear much shifting about in the course of their useful life, a cheap bitumen with its well known liability to crack, should be guarded against.

On all hygroscopic lead-covered cables a strong point should be made of seeing them actually laid, noting that the sealed ends are not damaged, and when the jointing is in progress, the time occupied on good plumbs is well spent.

Too much care cannot be taken with the end connections, and all dividing boxes should be of ample size and they should be designed consistently with the confined positions

they have to occupy in the roads. The ordinary pattern of three-way disconnecting box is often quite unsuitable, as



Stassano Electrical Furnace.

it is frequently impossible to accommodate the bend on the branch cable; what is greatly needed is a box having two of the ways running out at the end of the box, and it need only be of simple design.

A liberal use of gas-tight switch-fuse link distribution boards is also a great advantage, and it adds considerably to the efficiency and handiness of the system.

Joint-boxes buried in the roads are not to be recommended, owing to the fact that the ground is mostly in a state of compression, and is subject to upheavals with consequent damage to the cables, usually at the glands of the joint-box.

Duplicate cables should be run to all important distributing centres, and wherever possible they should be run by different routes; it is of little use to run duplicate cables side by side, for the chief causes of cable failures are due to falls of roof, blasting—I have known a joint box to be blown to pieces during blasting operations—and the derailing of tubs.

An extensive knowledge of fault-finding methods is not necessary in this class of work, for faults due to surface damage are readily localised by cursory and yet methodical inspection; a knowledge of some of the more simple fault-finding methods will, however, often save unnecessary cutting of the cables.

A cheap form of cable sling to be employed in place of the more expensive pig-skin now used has lately been brought to the writer's notice; it consists of a circlet of rope passed over the cable and looped through itself.

Some manufacturers, whilst leaving nothing to be desired in the design of their machines and apparatus, overlook the point of accessibility and suitability of the terminal connections, a small detail, but one conducing greatly to the lot of the colliery man. Although the foregoing notes merely touch the fringe of mining mains work, I trust they may lead others to give your readers the benefit of their experience.

AN ELECTRICAL SMELTING FURNACE FOR STEEL.

With a view to reducing the cost of production, to meet increasing competition, but without affecting the quality of its steels, the Bonner Fräserfabrik G.m.b.H. discontinued the use of ordinary crucible furnaces at the beginning of the present year, and introduced electric furnaces of the Stassano type.

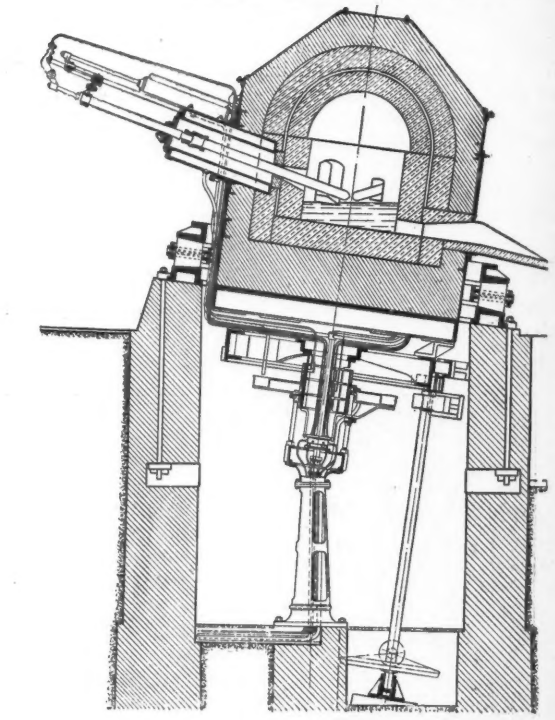
This company produces tool steels of various special qualities as well as soft cast-steel containing from ·08 per cent. to ·18 per cent. of carbon for small machine parts, such as are required in motor-car work.

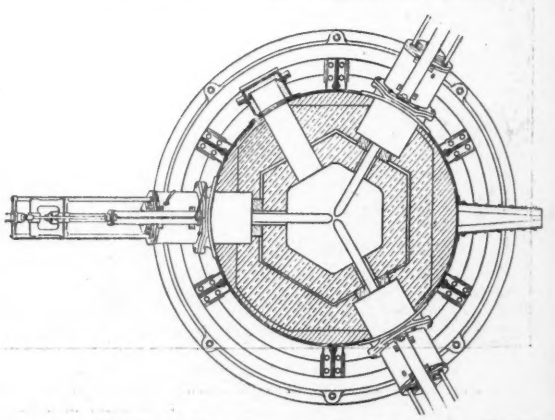
The existing 32 crucible furnaces, each containing six crucibles of about 77 lb. capacity, were replaced by a revolving Stassano furnace, taking a charge of 1 ton and requiring 250 H.P. to work it. A second similar furnace was also installed as a spare and for future extensions.

A three-phase 50 ~ supply was taken from the local company at 5,200 volts pressure and reduced to 110 volts by transformers. The current fluctuations, without any special starting or regulating devices, were quite small, and caused no trouble to the supply company. The whole of the electrical parts are thoroughly insulated as a protection to the workmen.

The furnace has been in continuous use since January, producing cast-steel containing ·08 to ·18 per cent. of carbon, about ·06 per cent. of phosphorus and about ·03 per cent, of sulphur. It has also produced occasional charges of tool steel containing 7 per cent. to 1·3 per cent. of carbon with various additions of chromium, tungsten, nickel, &c.

The basis of the charge is formed of wrought-iron stampings, turnings, &c., obtainable at from £3 to £3 5s. a ton.





Sectional Plan and Elevation of Stassano Steel Furnace.

The whole treatment of a charge of 1 ton occupies about 5 hours, of which about 1½ hours are employed in removing the excess phosphorous, sulphur and oxygen. About 900

908.

by a
and
econd
as a

taken
volts
ts by
tions,
regu-
and
com-
parts
rotec-

nuous
-steel
t. of
horns
r. It
ges of
to 1·3
litions

ned of
&c.,
ton.

RNACE.

about
noving
nt 900

KW.-hours are used, and, including rebate, these are obtained at a cost of about ·55d. per KW.-hour, or about £2 total. Three attendants are required on the average, making due allowance for carriage of the charging material, replacement of electrodes, &c. The total cost of a ton of molten metal, therefore, works out somewhat as follows :—

Interest on capital cost	£0	5	0
Cost of charge, including special additions ...	3	10	0
Current consumption, including heating during the intervals when not smelting	2	5	0
Cost of fire-brick lining		12	0
Wages		10	0
Electrodes		2	6
Cooling water			6
Total	£7	5	0

The firebrick lining of the furnace stands about 70 charges uninterruptedly, so that every 20 or 25 days the furnace has to be completely shut down for a period of five days to allow the lining to be replaced. The mechanical part of the furnaces have shown no signs of wear up to the present.

The chief advantage of this Stassano furnace lies in the fact that it enables cheap charging material to be used in place of expensive Swedish iron. It also enables 1 ton charges of exactly predetermined quality to be produced, and the steel leaves the furnace at a higher temperature and in a more fluid state than is the case with the older furnaces.

A view of the Stassano furnace and a sectional elevation and plan are shown on page 342.

The smelting chamber has three openings in the side, through which the three electrodes project at a height just above the surface of the molten metal, so that most of the heat reaches the steel. In order to ensure the necessary thorough mixing of the charge, the whole furnace is arranged for occasional rotation about an inclined axis by means of a 5-H.P. motor and spur gear.

The electrodes are fed by means of small hydraulic rams directly connected to the electrode holders. The latter are carried in water-cooled cylinders.

Whilst the furnace is rotated, neither the current nor the water supply need be interrupted—the former being fed through collector rings and the latter through a universal joint.

Furnaces of this type are made in all sizes, from those taking a 450-lb. charge and using 100 H.P., to those taking 10-ton charges and requiring 2,000 H.P. They can be fed with direct or alternating current.

TELEGRAPH and TELEPHONE NOTES.

Broken Telephone Insulators.—According to evidence tendered by the P.O. authorities before the Brentford Court, one of the local circuits suffered from insulator breakages at the rate of 100 per month, and on one day recently 160 insulators were broken. Apparently the youth of the district has caught the "pot hunting" fever.

Cardiff Telephones.—A new central battery exchange is nearly completed in the central post office in Westgate Street. The work has been carried out by the British Insulated and Helsby Cables, Ltd.

Glass Telegraph Poles.—The *Telegraph Age* states that in Europe glass telegraph poles are now being used, and that patents have been granted in Germany and the United States for a machine to be used in their manufacture. These poles will be proof against the ravages of insects, and the Imperial Post Department of Germany has already ordered these poles to be used in its telegraph and telephone systems.

Natal Statistics.—The Postmaster-General of Natal has published his report for 1906 on the telegraph and telephone systems under his charge. The length of telegraph line in the Colony was 3,132 km. with 10,829 km. of wire, while the figures for the telephone service were 228 and 3,428 respectively; 52 km. of line and 296 of wire were owned privately. These figures represent an increase over the figures of the previous year. To the telegraph service had been added 217 km. of line and 402 of wire, while the increase in the telephone system was 12 km. of line and 233 km. of wire. The increase in privately-owned lines and wires was 2 and 17 km. respectively. The internal traffic amounted to 204,204 telegrams, while 207,896 were sent to foreign parts, and 265,252 were received from abroad; 15,756 telegrams passed through the Colony in transit, making the volume of business dealt with, 693,108 telegrams. Receipts amounted to 1,371,488 fr. from the telegraph and 170,656 fr. from the telephone system.—*Journal Télégraphique.*

Servian Statistics.—During 1906 the telegraph receipts amounted to 290,118 fr. for the inland service, 174,630 fr. for the international, and 36,667 fr. for the "transit" service, which, with miscellaneous receipts, makes a total of 502,588 fr. The expenses amounted to 2,484,385 fr. The telephone system owned 1,446 km. of line and 7,321 of wire. There were 1,750 stations, and 2,958,734 conversations were dealt with, which brought in a revenue of 219,319 fr.—*Journal Télégraphique.*

Telegraph Ship for Sale.—The Mexican Telegraph Co. are offering the C.S. *Mexican* for sale. She recently repaired the Western Union Co.'s cable off Halifax, N.S., and is now berthed at Atlantic Basin, Brooklyn.

Telegraphic Interruptions and Repairs :—

Cables.		Interrupted.	Repaired.
Curacao-Coro Curacao-La Guayra Curacao-Maracaibo	Closed	Jan. 12, 1906 ..	..
Tarifa-Tangier		Jan. 18, 1904 ..	..
Port Arthur-Chifu	(Closed)	Mar. 9, 1904 ..	..
Las Palmas—Arrecife		May 18, 1908 ..	..
Pera-Dardanelles		May 20, 1908 ..	..
Sierra Leone-Accra		May 28, 1908 ..	..
Kwandang-Menado		Aug. 5, 1908 ..	..
Djedda-Souakim		July 27, 1908 ..	..
Assab-Massouah		July 28, 1908 ..	..
Cadiz-Teneriffe		Aug. 20, 1908 ..	..

Wireless Telegraphy.—The G.E. Railway Co.'s Continental steamers are being equipped with wireless telegraph apparatus, and a wireless station has been erected at Parkeston with a radius of transmission of 300 miles. The Lodge-Muirhead system has been used.

According to the *Débats*, both wireless telegraphy and telephony will be employed in the German army manœuvres in Alsace-Lorraine, and 60 ft. masts have been erected in connection with the telegraphic apparatus.

Wireless Telephony.—The de Forest Co. has signed a contract with the Metropolitan Life Insurance Co., for installing apparatus on the tower of the company's new building, with a view ultimately to establishing direct wireless telephonic connection with the Eiffel Tower, Paris. The radius of action is estimated at about 1,000 miles in the first instance, but improvements are in sight which will greatly increase this distance.

In our last issue we referred to the successful results obtained with experimental apparatus on the Eiffel Tower, Paris, communication being established over some 500 km. According to the *Times*, the transmitter used on the tower embodies the Poulsen arc, and the receiving apparatus includes Captain Ferrée's electrolytic detector.

CONTRACTS OPEN and CLOSED.

OPEN.

Australia.—Adelaide.—October 2nd. G.P.O. Power plant for charging accumulators for telegraph purposes.

Belgium.—Brussels.—September 2nd. Tenders are required by the company for narrow gauge railways (Société National des Chemins de fer Vicinaux) for the supply and laying of electric cables, ducts, &c., for the equipment for electric traction of the Brussels to Grimberghen section of the Brussels-Humbeek railway. Specifications Nos. 11 and 51, 1908, may be obtained on payment of 10d. each, and plans at 12s. 10d., at 14, Rue de la Science, Brussels.

Cairo.—September 12th. The Railway and Telegraph department requires tenders for various material.

Dublin.—September 4th. 500 single-phase and 100 three-phase A.C. meters for the Corporation. See "Official Notices" August 21st.

September 4th.—Boiler plant, &c., at Pigeon House generating station for the Corporation.

East Indian Railway.—September 16th. 600-KW. three-phase alternator; gas-engine alternators and equipment. See "Official Notices" to-day.

France.—Angouleme (Charents).—September 5th. The Commander of the Engineers' Corps requires tenders for cables, wires, iron structure, &c., for three-phase motor and transformer installations.

Germany.—The municipal authorities of Suhl are about to invite tenders for the establishment of a central electric lighting station in the town.

September 28th. The Prussian Railway authorities invite tenders for a locomotive turntable of 20 metres diameter, controlled by electricity. Particulars may be obtained, at 1s. cash, at the chief office of the Railway Administration.

London.—L.C.C.—September 8th. Cables, cable-boxes, &c., for East Greenwich generating station and Woolwich Road car depôt; electric wiring for car depôt; switchgear; and six 500-kw. and one 150-kw. motor-generators, for the L.C.C. See "Official Notices" August 7th.

Metropolitan Asylums Board. — September 1st. Storage battery, booster, switchboard, &c., for the training ship *Exmouth*. See "Official Notices" July 31st.

Hackney.—August 31st. Electric light and power fittings, also bell and telephone installation for Pavilion "B" at Homerton Infirmary for the Guardians. For plans see Clerk of Works on site (High Street, Homerton).

Merthyr Tydfil.—September 21st. Hills, Plymouth and Co., Ltd., require tenders for stores, including electric appliances, india-rubber goods, &c.

Perth.—August 29th. The T.C. requires tenders for the electric lighting and power installation in connection with the erection of the new City Hall. Plans at the office of H. E. Clifford, F.R.I.B.A., 225, St. Vincent Street, Glasgow.

Russia.—September 14th. The Town Clerk of Odessa (Upiawa) requires tenders for a concession to erect and work a power and lighting supply. A central station of a minimum of 6,000 h.p. is to be erected and equipped.

Salford.—September 14th. Lighting and power feeder, and distributor pillars for the Electricity Committee. See "Official Notices" to-day.

Sligo and Leitrim.—September 5th. The Board of Governors of the District Lunatic Asylum wants tenders for lighting the Institution, either electrically or with petrol gas (about 450 lights). Messrs. Anthony Scott & Son, architects, 49, Upper Sackville Street, Dublin.

Soller.—September 5th. The municipal authorities of Soller in the Balearic Islands will adjudicate upon tenders for installation, maintenance and exploitation of electric lighting for 15 years from November 1st, 1908. A deposit of 370 pesetas is required.

Spain.—September 3rd. Tenders are being invited until September 3rd by the municipal authorities of Villalba de los Barros (province of Badajoz) for the concession for the electric lighting of the town during a period of 20 years. Tenders are to be sent to El Secretario del Ayuntamiento de Villalba de los Barros, whence particulars may be obtained.

Tenders have just been invited by the municipal authorities of Onda (Castellon province) for the concession for the electric lighting of the town during a period of 10 years.

Huelva.—September 29th. Two electrically-driven cranes and tip wagons. Junta de Obras del Puerto.

Stoke-upon-Trent. — September 8th. Water-cooling apparatus for the Electricity Committee. See "Official Notices" to-day.

Stretford.—The U.D.C. invites tenders for steam boiler, economisers, and mechanical stokers for the electricity works.

Watford.—September 1st. Surface condenser and pumps for the U.D.C. See "Official Notices" July 31st.

CLOSED.

Aldershot.—The U.D.C. has accepted the tender of Messrs. Babcock & Wilcox, Ltd., for a patent mechanical chain-grate stoker at the electricity works, at £155.

Australia.—Melbourne.—According to the *British Australasian*, the Postmaster-General has accepted the Western Electric Co.'s tender for the supply and erection of a mammoth common battery switchboard for the new central telephone exchange, Melbourne. The contract price is £43,641, and the new board is to have capacity for 9,000 subscribers' lines, and an ultimate capacity of 11,700 lines. "It is to be delivered in nine weeks, and its erection will take from nine to 12 months additional. In the face of keen competition, the contract has been secured by a British Corporation with an Australian branch. The contract price embraces the supply of subscribers' instruments and switchboards for private branch exchanges. For the big board itself £31,541 is to be paid, the balance of the money being for subscribers' instruments. Altogether nine firms submitted tenders, Germany, the United States, Sweden and Great Britain, being represented. The highest tender was £58,000."

Melbourne City Council:—

Johnson & Phillips.—Insulated copper cable, £240.
Lawrence & Hansen.—500-kw. motor-generator, £1,885.
Dorman, Long & Co.—Rivet-steel girders for conveyor towers, £133.

Bahamas.—The *Standard* says that Messrs. Crompton and Co., Ltd., have obtained the order for the electrical installation at Nassau, the capital of the Bahamas. "This will be the first thing of its sort in those islands. American firms made great but unsuccessful efforts to obtain this contract."

Canada.—Ottawa.—A Canadian correspondent writes: "A contract for over 1½ million dollars was signed in Toronto early in August for electrical development. The successful tenderer was the F. H. McGuigan Construction Co. for the erection of the electric power transmission line for the Ontario Government, for $1,270,000. The agreement was signed by the Commissioners and by Mr. McGuigan. The total mileage of the line when completed is to be 293 miles. There were 27 tenders submitted, McGuigan's being the lowest. There were a number of tenders for steel towers and several for the cables, but the Government decided to accept the bulk tender of Mr. McGuigan. The leases of town sites are being secured at a cost of about $146,500 for 290 miles, as compared with the Electric Development Co.'s expenditure of $417,000 for its right of way for 87 miles. The Hydro-Electric Commission, who conducted these matters for the Ontario Government, in their estimate of cost reckoned copper at 28 cents per lb.; the present market value is only about 12 cents, which will still further reduce the cost of construction.

Dartford.—The U.D.C. has accepted the following tenders:—

Chamberlain & Hookham, Ltd.—Meters required up to June 30th.
S. W. Gibson & Co.—Wiring for condenser pumps and bath pump, £23.

Eccles.—The Borough Education Committee has accepted the tender of Messrs. Holman & Co., Manchester, for installing the electric light at the Clarendon Road Schools, at £182.

France.—The French Post and Telegraph authorities in Paris have just placed a contract with Messrs. Geoffroy & Delore, of Clichy, Paris, for the supply of 200 kilometres of telephone cable.

Glasgow.—The T.C. Tramways Committee has accepted the following tenders:—

Adjustable Cover and Boiler Block Co., Ltd.—Adjustable covers and blocks for Pinkston boilers.
Lahmeyer Electrical Co.—Copper bonds.

Manchester.—The contract for the complete installation of electric lighting and power for the new engineering laboratory at the Manchester University, has been placed with Messrs. Sewell and Varley, of Manchester.

Wrexham.—The following tenders were received for superheater, piping, &c., for the Corporation electricity department:—

Jas. Gordon & Co., London	(accepted)	£165
A. Bolton & Co., Manchester		167
A. Sugden, Ltd., London		177
McPhail & Simpson, Wakefield		189
H. & T. Dunks, Ltd., Dudley		200
Musgrave & Sons, Bolton		211
Adamson & Co., Dukinfield		215
W. B. Haigh & Co., Oldham		237
Galloways, Ltd., Manchester		238
Cruse Controllable Superheater Co.		362

CONTRACTORS' COLUMN.

[The following information is published in the interests of electrical contractors and others who are seeking for openings for new business. Considerable expense is incurred in the production of this column, and every care is taken to ensure that the information is new and accurate, but it will be understood that in a matter where so many correspondents are engaged, and where the amount of information to be handled is very large, this cannot always be guaranteed. If alleged inaccuracies are reported to the Editors, they will be fully investigated.]

ABERCHIRDER (Banffshire).—Extensions at U.F. Manse. Rev. G. Macfayden, U.F. Manse, Aberchirder.

ABERDEEN.—Dwelling house, University Road, for W. A. Ness; Sutherland and George, architects. Drying shed, 103, Holburn Street, for William M'Donald. Dairy and Farm Produce Market in Castle Street, for the Corporation.

ABERDOVEY.—Extension of the Literary Institute (£250 or £150).

ABERLOUR (Banffshire).—Roman Catholic Church (£1,100). A. M'Pherson, architect, Edinburgh.

ALDERSHOT.—New offices, Grosvenor Road, for Ind, Coope & Co., Ltd.; houses, Newport Road, for E. Smith; Bellevue Road, for C. Edwards; Ash Road, for Mr. Mitchell; York Road, for W. L Edgoose, builder, Albion Works, Church Lane; Hillside Road Eggar's Hill, for Mrs. Forrester.

ALNESS (Ross-shire).—Additions to the Church Manse.

ARBUTHNOT (Kincardine).—Parish Hall. Rev. C. Dunn, Vicar.

ARMAGH.—Renovation and improvement of Tontine Buildings for Town Hal and municipal offices.

ARNOLD (near Nottingham).—New Baptist Church in Cross Street.

ASCOT.—Extensive alterations, St. George's school; electric lighting to be installed. Mr. Mason, architect, Surbiton.

AUCKLAND.—Extensions and alterations to Workhouse (£16,900).

BAILDON (Yorks.).—Eight semi-detached houses, Bank Top, for W. Bales.

BAKEWELL.—Plans being prepared for new public baths. District Council.

BAMFURLONG (near Wigan).—Reported pending developments. Cross, Tetley & Co., colliery proprietors.

BANGOR.—Cathedral to be lit by electricity.

BARNET.—Rebuilding three shops (occupied by Harbard & Co., W. J. Wells, and Mr. Peake), destroyed by fire; also dwelling house.

BARNOLDSWICK (near Colne, Lancs.).—New weaving mill to be built.

BARNSLEY.—Eighteen houses, Garden Village, Thurnscoe, for the Barnsley British Co-operative Society, Ltd. E. W. Dyson, architect, 10, Regent Street, Barnsley.

BARROWFORD (near Nelson).—Three pairs of semi-detached houses. Hitchen & Pritchard, architects, 46, Manchester Road, Burnley.

BELPER.—New post office (£1,200). Hunter & Woodhouse, architects, Belper; J. W. Haynes, builder, Belper. Girls' school, Kilburn Road, for Workhouse.

BESSBROOK (Co. Armagh).—New female schools at Convent of Mercy. J. J. M'Donnell, architect, 27, Chichester Street, Belfast.

BEXHILL-ON-SEA.—Extensive additions to St. Barnabas Church (£6,500). A. W. Blomfield & Sons, architects; Dove Bros., builders, Islington, London.

BILSTON.—New Wesleyan Sunday Schools at Hurst Hill, Coseley. A. H. Screen, 15, Wood Cross, near Bilston. Probable re-erection (after fire) of goods station and offices at Deepfields (London and North-Western Railway).

BIRKENSHAW (Bradford).—Offices for Messrs. Farnell.

BLACKPOOL.—New United Methodist Church, Shaw Street, South Shore.

BLAINA (Mon.).—New hall for Blaina Forward Movement.

BOLTON.—Extensions and rebuilding of premises in different towns. Magee, Marshall & Co., W. Tong & Sons, and Messrs. Sharman, brewers, Bolton. Two villas, Ashley Bridge, Blackburn Road, for Geo. Sykes.

BOOTLE.—New smelting works for William Harvey & Co., Hayle, Cornwall.

BRADFORD.—Library, Manningham, for the T.C.; City Architect, Whitaker Buildings, Brewery Street, Bradford. Sunday schools (£1,500).

BRIDGWATER.—Alterations and additions to the Municipal buildings (£5,500).

BRIGHOUSE.—Secondary school for girls.

BRISTOL.—New chapel at Stapleton Workhouse, to accommodate 420 (£1,500).

BRITTAS (Co. Dublin).—Residence at Lugg. Specification held at 48, Arran Street, East Dublin.

BROUGHTON.—New schools at Townsend (£2,000).

BURTON LATIMER.—Factory for Standard Boot Co.

CARDIFF.—Additions to Cardiff Steam Laundry, Mining Street, Cathays, Cardiff. H. Budzen, architect, 95, St. Mary Street, Cardiff.

CASTLETON (Yorks.).—Parish room (£600). Rev. J. H. Brookshank, vicar.

CHARMOUTH (Dorset).—Proposed new Church Hall.

CHEADLE.—Parish Hall, Cheadle Hulme (£1,800). Rev. H. Tyson, vicar.

CHEETHAM (Manchester).—Extension of baths (£6,000 to £7,000).

CHELMSFORD.—New offices for the Essex Education Committee. F. Whitmore, architect, Duke Street, Chelmsford.

CHELTENHAM.—Additions to Co-operative Store. T. Malvern, architect, 21, Winchcombe Street, Cheltenham.

CHEPSTOW.—Master's residence at Workhouse. J. W. Rodger, architect, 14, High Street, Cardiff.

CHIPPENHAM.—Place of Worship. Downings & Rudman, builders, Chippenham.

CHORLEY.—Proposed public baths. Corporation.

CLACTON-ON-SEA.—Church of St. James.

CLECKHEATON.—New secondary school. Clerk of the District Council.

COCKFIELD.—Fifteen houses. Specifications held by T. Dodd.

COLNE.—Nineteen houses, Alkincoates Road, for Mr. Fothergill; houses, Skipton Old Road, for Geo. Bower.

CORK.—Alterations to operating room. J. Cotter, Clerk of Union.

COVENTRY.—Development of large estate at Wyken (about 2,000 houses) by Cunningham & Merryweather (North of England firm).

CREWE.—New cold storage premises. Alderman H. Hoptroff.

CRIEFF.—New hall for the Royal Oak of Strathearn Lodge of Good Templars (£300).

DARTFORD.—Additions to works of Burroughs, Wellcome & Co., Snow Hill, E.C.

DARTMOOR.—Factory for converting peat into fuel. Dr. M. E. Kenberg, scientist.

DARWEN.—Mixed school, Ellison Fold, to accommodate 500 children. Education Committee.

DEAL.—Houses, Harold Road. J. H. Denne & Son, builders, 7A, Queen Street, Deal.

DENBIGH.—New Public Hall.

DESKFORD (Banffshire).—Repairs to Church buildings (£100). Rev J. Morrison, vicar.

DESBOROUGH (near Market Harborough).—House, Pioneer Avenue, for E. Lewin.

DIPTON (Co. Durham).—New shaft at Delight Colliery, whole of machinery (except winding engine), to be worked by electricity, for John Bowes & Partners.

DONCASTER.—Extensions to the Market for T.C. (£4,000). Important lock extensions for Sheffield and South Yorkshire Navigation Co. (£50,000). Six houses and outbuildings for T.C.; Borough Surveyor, 3, Priory Place, Doncaster. Six new cottages (workmen's) for the Corporation; architect, Borough Surveyor; contractors, Jenkinson & Burton, Doncaster.

DORNOCH.—New United Free Church.

DUNFERMLINE.—Fifty houses, Town Council.

DURHAM.—Two houses, Croxdale, for A. Metcalfe.

EASINGTON (Co. Durham).—Houses, Station Town, for L. Proudlock and Wilton; Hordew, for H. Bell, W. McKenna and the Colliery Co.

EBBW VALE.—Alterations and additions to property at Beaufort, for Mrs. Tonald. Surgery, Beaufort, for Ebbw Vale Doctors' Fund Committee; H. Waters, architect, Market Chambers, Ebbw Vale.

ELHAM.—Repairs at Cottage Homes, Chereton, for Union. R. Lonergan, clerk.

ESSLEMONT (Aberdeenshire).—Alterations Wateridgemuir Farm. W. Davidson, architect, Ellon.

EXMOUTH.—Winter Garden in Imperial Hotel grounds.

FARINGTON (Preston).—Extension of St. Paul's Church to seat 500. J. A. Seward, architect, Preston.

FARNWORTH.—Offices, Egerton Street, for Richardson & Co.; pending developments, local Co-operative Society.

FFORESTFACH.—Ten houses, Armine Road. C. S. Thomas, architect, 15, Wind Street, Swansea.

FORFAR.—Proposed new Swimming Baths. Mr. Blanc, architect, Edinburgh.

GAMBRIE (Banffshire).—Proposed new Infant School. Mr. Sutherland, architect, Aberdeen.

GARSTANG (Lancs.).—Hospital. Garstang Rural Council.

GELLIGAER.—Infectious Diseases Hospital at Pengam (£7,800). Vodden and Lee, builders, Gilfach, Bargoed.

GLASGOW.—Motor Garage and Store in Nithsdale Road, Pollokshields, for E. Watson, 170, Argyle Street, Glasgow.

(Springburn).—Masonic Temple in Vulcan Street, for Lodge of Freemasons, Kenmure; A. Grant, 631, Alexandra Parade. Additions to Belmont House, for Hugh Reid.

(Pollokshaws).—New Hall and other buildings in connection with West Church (£1,200). Rev. W. McAlpine, vicar.

(Saltcoats).—New Post Office, Chapwell Street.

GOLCAR.—House at Leymoor, and branch premises at Townend, for Golcar Co-operative Society. Lunn & Kaye, architects, Milnsbridge.

GORSEINON (Glam.).—English Calvanistic Methodist Chapel. D. L. Jones, architect, Thomas Street, Llanelly.

GOSPORT.—Baptist church, Avenue Road.

GREENOCK.—Addition to Sick Room, Smithston Asylum.

GRINDLETON (near Clitheroe).—Important new sewerage scheme contemplated. Grindleton Parish Council.

GRINTON (Yorks.).—Repairs to vicarage. Rev. B. Gregory, vicar.

GUILDFORD.—Additions to Workhouse (£2,500). Chairman of the Guardians.

HALIFAX.—Warehouse for G. Sheldrake & Sons, Ltd; R. Horsfall & Son, architects, 23A, Commercial Street, Halifax; Turner & Son, builders, Halifax. Three shops, Rawson Street and Powell Street, for Gaukroger & Son, tailors; T. Kershaw, architect, Lancs. and Yorks. Bank Chambers, Halifax; W. Greenwood and Son, builders, Halifax.

HAMILTON.—Primitive Methodist Church.

HANLEY.—Re-erection of business premises, Broad Street. Field, drapers, Hanley.

HARROGATE.—Additions to "Sunnybank," Knox. Frank Caws, architect, Fawcett Street, Sunderland.

HASLINGDEN.—New station or important developments. L. & Y. Railway Co., Hunt's Bank, Manchester.

HAYES.—New Baptist Chapel.

HEDDON-ON-THE-WALL (Northumberland).—New Wesleyan Sunday Schools, &c. J. Taylor, architect, Newcastle-on-Tyne; Charlton and Sons, builders, Crawcrook, near Ryton.

HERNE BAY.—House for W. Rouse, Oxenden Park. J. Huxtable, architect, Herne Bay.

HEBDEN BRIDGE.—Baptist Chapel, Charlestown Hill.

HERTFORD.—County record and strong room for Herts C.C. U. A. Smith, County surveyor, Hatfield.

HINDLEY (near Wigan).—New Congregational Church (£3,000 to £4,000). H. Wade, architects, Birley Street, Blackpool.

HOLLINGWORTH (near Manchester).—Manse for Congregational Church. T. Aldons & Son, builders, 1, Marlow Street, Hadfield.

HORWICH (Lancs.).—Structural alterations and extensions. Victoria Mills. Messrs. Taylor.

HUDDERSFIELD.—Fifteen houses and shop at Cottage Retreat, Manchester Road. P. Taylor & Co., architects, Central Buildings, Milnsbridge.

ILFORD.—New Unitarian Church, High Road.

ILKESTON.—Proposed structural alterations. Local Co-operative Society.

KENFIG HILL (Bridgend).—School Hall, for English Presbyterian Church, Kenfig Hill. A. L. Thomas, architect, Church Street Chambers, Pontypridd.

KERROW MOOR (Cornwall).—Two houses, Mr. Coumbe, Rosevean, St. Austell.

KIDDERMINSTER.—House, Marlpool Lane. W. Phipps, Wordsley.

KINGSTON-ON-THAMES.—Alterations to the Workhouse, Norbiton Common (£6,750); alterations and additions to isolation ward at infirmary (£257).

LANCASTER.—Villa at the County Lunatic Asylum for 50 private patients. Mr. Littler, County Architect, Preston.

LEEDS.—Mortuary at workhouse for B.G. T. Winn & Sons, architects, 84, Albion Street, Leeds.

LEIGH (South Lancs.).—Developments promised here. Wigan Coal and Iron Co., Ltd., Wigan.

LEIGH-ON-SEA.—Two residences on Leigh Park Estate, for Mr. Robey.

LEYLAND.—Proposed new fire station. District Council.

LITHERLAND (Liverpool).—Stabling, &c., and new mortuary, for U.D.C. A. H. Carter, surveyor, Sefton Road, Litherland.

LITTLEOVER (Derbyshire).—New sewerage scheme (£5,000). Surveyor, Shardlow Rural Council, Derbyshire.

LIVERPOOL.—New wing at the Convent of the Sisters of Charity, May Place, Old Swan. Row of houses, Herondale Road, Mossley Hill; J. R. Pritchard, builder.

LONDON (Wigmore Street, W.).—Rebuilding No. 65 (shop). T. H. Kingerlee and Sons, builders, Oxford.

(James Street, W.).—Rebuilding grocer's shop. Meech and Goodall, builders, Streatham Hill, S.W.

(Camden Town, N.W.).—Rebuilding piano factory in Bayham Place, for Monington & Weston.

(Portman Square, W.).—Additions and alterations, St. Thomas's Church. Rev. A. G. Locke, vicar.

(Leicester Square, W.).—Alterations to premises for Stagg and Mantle, drapers. Hall, Beddall & Co., builders, Waterloo Bridge, S.E.

(Trafalgar Square, W.C.).—Additions to National Gallery (£15,979). F. & H. F. Higgs, builders, Loughborough Junction, S.W.

(Great Portland Street, W.).—Rebuilding Nos. 144-6. D. Prosser, builder, 23-25, Charlotte Street, Fitzroy Square, W.

(Moorgate Street, E.C.).—Alterations to No. 17. L. H. and R. Roberts, builders, 34, Rheidol Terrace, Islington.

(Gracechurch Street, E.C.).—Alterations to Gracechurch Buildings. Holliday & Greenwood, builders, 114A, Loughborough Park, Brixton.

(Marble Arch, W.).—Adaptation of premises for J. Lyons & Co., Cadby Hall, Kensington.

(Oxford Street, W.).—Alterations to premises of H. Dale & Co., ladies' tailors. S. Jones & Co., 14, Gray's Inn Road, W.C.

(Chelsea, S.W.).—Buildings, Chelsea Bridge Road. Higgs & Hill, builders, Crown Works, South Lambeth.

(Oxford Street, W.).—Alterations for Singer's Sewing Machine Co. E. Pollard & Co., builders, 29, Clerkenwell Road, E.C.

LYDBROOK (near Ross).—Public elementary school. N. H. Medlaw, architect, 15, Clarence Street, Gloucester.

MAIDSTONE.—Houses, Sheals Crescent, for J. J. Hunn, builder, 60, Upper Fant Road, Maidstone.

MANCHESTER.—Proposed enlargement of United Methodist College (£15,000); new Wesleyan Church Schools in East Road, for Longsight Circuit.

MANSFIELD.—Houses, Harrington Street, for C. F. Taylor; Murray Street, for T. H. Witham; Mount Street, for Lucas Bros.; Carter Lane, for J. H. Stevenson; Derby Street, for J. Greenwood, builder, Wood Street.

MARGATE.—Parish room. Rev. R. F. Beven, vicar.

MELKSHAM (Wilts.).—New Baptist Sunday Schools. W. W. Snailum, architect, Trowbridge; Bigwood & Co., builders, Melksham.

MERTHYR TYDFIL.—Houses, Conners Street, Penydarren, for the Gellifaelog Building Club; Amberton Place, Penydarren, for John Jones; Quakers' Yard, for Mrs. M. Jones; Danyderi, for the Danyderi Building Club; additions to business premises, for Roger Edwards, draper, 123, High Street; villa, Gwaelodygarth Lane, for J. W. Morris. Thirty houses for T.C. at Danyderi (£6,210). E. P. Davies, builder, Dowlais.

METHLICK (Aberdeenshire).—Building, Beaton Hall. James Cobban, architect, Haddow House, Aberdeen.

MOSES GATE (near Bolton).—New offices, Egerton Street, for Richardson, Tuer & Co., loom makers.

NAIRN.—New Free Church, Gordon Street (£1,200 to £1,500).

NANPEAN (Cornwall).—Church room for J. B. Fortescue, Boconnoc, Cornwall.

NEWCASTLE.—Wesleyan Church, Clara Vale.

NORTHFLEET (Kent).—Houses for Clements & Hotter. Bridgland & Clay, architects, Gravesend.

OAKHILL (Stoke).—Twelve houses, Daintry Road, for W. Ball.

ARNSIDE (Westmoreland).—Girls' school, for H. H. Llewellyn. R. Bradley Barker, architect, Arnside.

OXFORD.—New church of St. Stephen. A. M. Mowbray, architect, 117, St. Aldate's Street, Oxford.

PARTICK.—Two semi-detached villas, York Avenue, Jordanhill, for James Speed; two semi-detached villas, Bishop's Road, Jordanhill, for Isdale, Robertson & Sons.

PATELEY BRIDGE.—New Wesleyan Methodist Church (£2,500).

PENCADER (Carmarthenshire).—New Calvanistic Methodist Church. D. Davies, architect, Henllan; T. Jones, builder, Llangranog, Henllan, Carmarthenshire.

PENCAITLAND (Haddingtonshire).—Additions to school. Lyle & Constable, architects, 3, Hill Street, Edinburgh.

PERTH.—Four double villas at Kinnoull. D. Johnston & Sons, builders, Perth.

PLUMBLEY (near Knutsford, Cheshire).—New chemical works, electrically equipped for power and light (£12,000). F. W. Stocks, architect, Middlewich; J. Moffat, builder, Manchester.

PONTARDULAIS (Glam.).—New premises, Hope Street, for Pontardulais and Gorseinon Co-operative Society, Ltd. The Secretary.

PONTEFRACT.—Houses, Red Hill, for S. F. Gregory.

PORT SUNLIGHT.—Pending developments to Lever Bros'. premises.

PUDSEY.—Additions to dwelling-house, Perseverance Street, for H. Stansfield; addititions to King's Arms Hotel, Greenside, for J. Tetley and Son; additions to offices, Littlemoor Road, for B. Johnson.

RAINHAM.—House, Century Road, for A. Way.

RAUNDS.—Houses, Harcourt Street, for J. E. Mayes.

RAWTENSTALL.—Villa Residence, Burnley Road, Crawshawbooth, for Ormerod Ashworth.

READING.—New Bakery and Stables for local Co-operative Society. Architects' Department, Co-operative Wholesale Society, Manchester.

ROMFORD.—New Board room and offices for B.G. (£11,521). J. S. Hammond and Son, builders, Romford.

ROWLEY.—Three Public Libraries. Wills & Anderson, architects, 24, Bloomsbury Square, W.C.

RUGBY.—New dormitory, servants' hall and minor alterations to Rugby School premises, 1, Hillmorton Road; tailors' workshop and educational hall for the Rugby Co-operative Society, Queen Street; alterations and additions to 4 and 5, School Street, for H. Pratt; additions to dwelling house, 10, Hillmorton Road, for W. N. Wilson.

RUNCORN.—New porters' lodge at Isolation Hospital (over £300). Surveyor, Rural Council, Runcorn.

RAYTON (Durham).—New church at Clara Vale, to accommodate 250 (£1,200).

ST. ALBANS.—New Primitive Methodist Church.

ST. AUSTELL.—Two houses at Penrithick, for S. Coombe, St. Austell.

ST. HELENS (Isle of Wight).—Houses, St. John's Wood Road. Wheeler Bros., builders, Monkton Street, Ryde.

SHEERNESS.—Proposed new school at Halfway Houses (£1,360). New Masonic Hall; E. J. Hammond, architect, 21, Balmoral Road, Gillingham, Kent.

SKIPTON.—New public library (£7,000).

SLIGO.—Proposed electric lighting of the District Asylum (to generate own electricity.) Rev. C. Flynn, chairman of the Committee of Management.

SLOUGH.—Houses, Wellington Street, for E. D. Rabbitt; Wexham Road, for J. M. Blair.

SOUTH SHIELDS.—Two shops, 36 and 38, South Frederick Street, for T. B. Carr. T. Y. Young, architect, 50, King Street, South Shields.

SOUTHEND-ON-SEA.—Bungalow residence, Rochester Drive, for G. Luck; bungalow, London Main Road, for A. D. Martin, builder, Finchley Road, Westcliff; bungalow and houses, Eastwood Road, for W. Rice; houses, Ramuz Drive, for D. W. Carr; Hamstel Road for Mrs. M. F. Leng; Woodfield Road for G. Watts; Leigh Road East for A. S. Barley; Ramuz Drive for R. Rudd; additions to laundry for the Albion Laundry Co., Eastwood Road.

SOUTHPORT.—Parish room, St. Cuthbert's, to be rebuilt.

STAFFORD.—New church institute in connection with St. Thomas's Church.

STEVENAGE.—New school (336 scholars) for Herts C.C.

STOCKPORT.—Free Library. Chairman, Free Libraries Committee.

STOKE-ON-TRENT.—New Wesleyan church, Stockton Brook. W. Campbell, architect, 2, Bagnall Street, Hanley; W. Thomas & Son, builders, Grafton Street, Hanley.

STRETFORD (near Manchester).—New works to be established in Trafford Park, for American and German firms. Extension to electricity build ngs for U.D.C.; E. Woodhouse, architect, 88, Mosley Street, Manchester.

SUTTON COLDFIELD.—New school, Green Lanes, Chester Road (to accommodate 200). Crouch, Butler & Savage, architects, 39, Newhall Street, Birmingham.

SWANSEA.—Alterations to premises, Waterloo Street and Park Street; C. T. Ruthen, architect, Swansea.

TAFF'S WELL (Glam.).—New English Chapel.

TETLEY RISE (Sheffield).—Model village (£200).

TIPTON.—Alterations and extensions of the Public Offices, Owen Street. W. H. Jukes, engineer and surveyor.

TREVISCO (North Cornwall).—New Wesleyan Methodist Church.

TRURO.—Proposed rebuilding of Western Inn for Redruth Brewery Co.

WAKEFIELD.—New United Methodist Church, Outwood. W. H. Dinsley, architect, Chorley; W. Richardson, builder, Outwood.

WALKDEN.—Reported extensions pending for Burgess, Ledward & Co., Wardley Mills; E. Rothwell, Linnyshaw Mills; and E. Lane & Sons, Hope Mills.

WALLSEND.—Boot factory for Wallsend Industrial Co-operative Society, Ltd. Sherbrooks & Hodges, architects, Newcastle-on-Tyne.

WALTON (Surrey).—New schools.

WATERLOO (near Liverpool).—Eleven houses, Sandheys Avenue, for T. C. Williams; four houses, Milton Road, for C. & W. E. Brooks.

WATFORD.—Extension of cooling plant at electricity works for U.D.C. (deposit £1). F. W. Pusey, chief engineer. Electricity Works, Watford.

WESTON-SUPER-MARE.—Baptist Church, Walliscote Road (£3,000); Silcock and Reay, architects, Bath. Three houses, Ashcombe Park; H. Price and W. Jane, architects, Waterloo Street, Weston-Super-Mare.

WHALEY BRIDGE.—House, Dig Lea Road, Furness Vale, for R. E. Knowles.

WHITLEY BAY (Northumberland).—Proposed new railway station, for the North-Eastern Railway Co.

WHITTINGHAM (Lancs.).—Extension of lunatic asylum (to accommodate 700) (£84,000).

WIGTON.—Church institute at Kirkbride.

WINCHESTER.—New Primitive Methodist Church, Rohley (£600).

WINGATE (Co. Durham).—Houses, for S. Colwill and Mr. Stoydale; shops for Mr. Proudlock.

WORMINGTON (Essex).—Alterations and additions to The Grove, for T. E. Smith. J. W. Start, architect, Colchester.

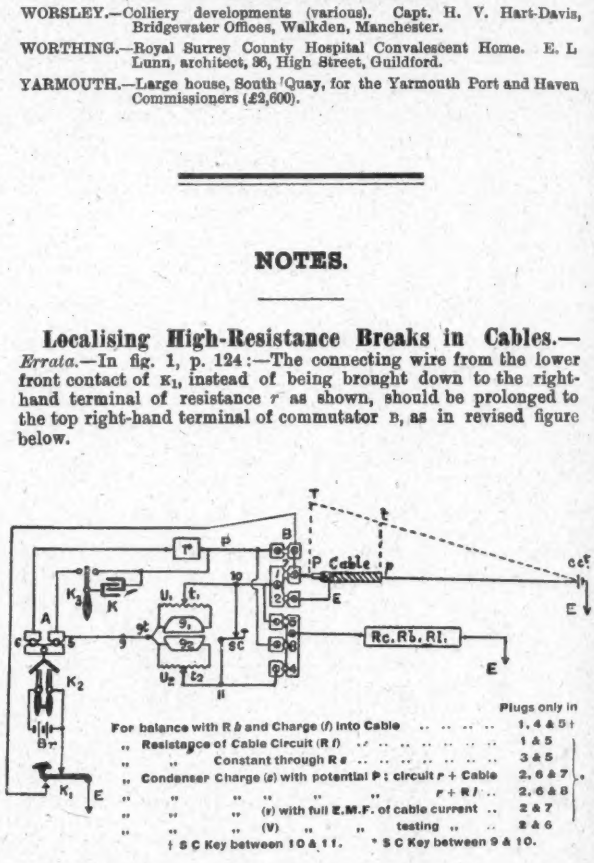
WORSLEY.—Colliery developments (various). Capt. H. V. Hart-Davis, Bridgewater Offices, Walkden, Manchester.

WORTHING.—Royal Surrey County Hospital Convalescent Home. E. L Lunn, architect, 36, High Street, Guildford.

YARMOUTH.—Large house, South Quay, for the Yarmouth Port and Haven Commissioners (£2,600).

NOTES.

Localising High-Resistance Breaks in Cables.—*Errata.*—In fig. 1, p. 124:—The connecting wire from the lower front contact of K_1, instead of being brought down to the right-hand terminal of resistance r as shown, should be prolonged to the top right-hand terminal of commutator B, as in revised figure below.


T
t
B
P Cable
K
K1
K2
A
E
Rc. Rb. Rl.
Br
Plugs only in
For balance with R b and Charge (f) into Cable 1, 4 & 5 †
Resistance of Cable Circuit (R f) 1 & 5
Constant through R a 3 & 5
Condenser Charge (c) with potential P; circuit r + Cable 2, 6 & 7 *
r + Rl 2, 6 & 8
(e) with full E.M.F. of cable current 2 & 7
(V) testing 2 & 6
† S C Key between 10 & 11. * S C Key between 9 & 10.

In left column, p. 125, lines 17 and 18:—Instead of T and T G, read t_1 and $g\ t$.

In left column, p. 125, line 48:—Instead of *charge throw c*, read *charge throw* C.

In right column, p. 195, line 33:—Read $\frac{f}{E_r}$.

Times are What we Make Them.—Michigan business men, and others, for that matter, says *Chicago Commerce*, are subscribing to and passing along the following creed:—

1. I will dispel from my mind any thoughts of hard times.
2. I believe there is more to be gained by push and aggressiveness than by idle talk.
3. I believe times are what we make them: I will add my influence toward making them good.
4. I will not allow the investment I have in my business to remain idle.
5. I am going to get rid of the old stock and restock with new.
6. I am going to run my business on business principles.

Are you with us?—*Western Electrician.*

Tramway Accidents.—On Wednesday afternoon, at Southend, a live trolley wire broke and fell upon a visitor, named William Harvey, who received a shock and had his straw hat burnt.

On Wednesday, at Halifax, a workmen's tramcar ran backwards while ascending Gilbert Hill, and subsequently left the rails at a curve, coming to a standstill at the kerbstone. The driver pluckily stuck to his post, but the 60 passengers made a hurried and safe escape.

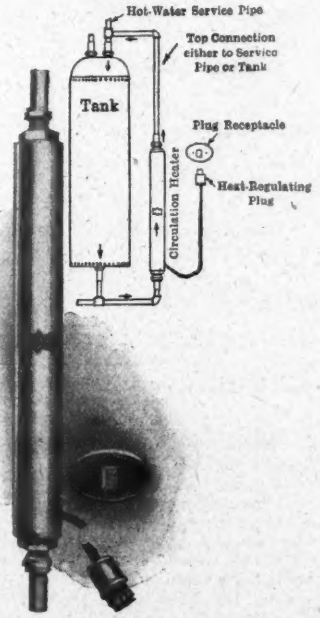
Electric Heat.—There are evidences that the use of electricity is swiftly emerging from the tentative to the fully commercial stage, at any rate in America. It seems almost wearisome to repeat it, but the kettle, chafing dish, and coffee percolator are in America in a strongly-established position such as we in England only dream of. Why it is that over there electric heating is going well, while here the question is still being asked as to whether electric heating "pays," is a problem which needs a good deal of solution.

The latest development was described by Mr. C. E. Waddell before the American Institution of Electrical Engineers, and consists of an electric heating system installed at the Biltmore Estate, North Carolina. From an account in the *Electrical Review* of New York, from which we quote, it appears that the cost of anthracite coal and the nuisance involved in its use, led to the introduction of electric heaters for the hot water system of the house and for the laundry work necessary. The installation is rated at 167 KW., 100 KW. of which is represented by the hot water heater and the balance by the laundry equipments. The system consumes about 20,000 units a month. The hot water heater consists of a small horizontal tubular boiler having electric heaters inserted in the tubes. This gave a thermal efficiency of about 85 per cent. The boiler is 3 ft. in diameter, 5 ft. long, and contains 20 flues, each of which encloses a 5-KW. heating element.

The laundry apparatus, so far as tests went, seemed to give pretty good results, varying with the size of the wash. One day 68 lb. of water were expelled for every 100 units supplied to the electric heater. On another day, for a somewhat smaller wash, 145 lb. of water were expelled for each 100 units. The laundry has been completely fitted up with ironing, drying and washing apparatus.

Due to the somewhat irregular character of the loads, the electric system is not under such a great disadvantage as might be supposed, and even supposing (as our contemporary points out) that the cost of a single thermal unit in the form of electrical energy may be high, the economy with which this is used brings the total cost much closer to that of an equivalent heating system using fuel. It is the inefficiency of the fuel-using apparatus which brings up the cost of its operation. What may be termed the "overall" economy of the system should be borne in mind. Besides fuel, there is money value in time and convenience, so that it may, in the long course of events, ultimately be recognised by the British public that cities without chimneys, smoke, inconvenience due to flue cleaning and grate furbishing, are really within the range of practical economics and a state of things to be sought after. In spite of the present apathy which appears to rest on the minds of English electrical engineers on this question, it will be a very strange thing if, in the near future, house warming by electricity does not become an accomplished fact

The *Western Electrician*, in referring to recent electric heating progress in America, says that the introduction of electric cooking apparatus, especially for use in the summer months, has developed a demand there for electric water heaters for the general supply of hot water about the dwelling. The Simplex Electric Heating



ELECTRIC HOT-WATER HEATER FOR THE HOUSEHOLD.

Co., of Cambridge, Mass., has recently put on the market a circulation heater for attachment to the range boilers, which our contemporary describes, and which seems to overcome many of the objections and difficulties of taking care of the hot-water problem electrically. As shown in the diagram, the heater is placed beside the boiler, connected at the bottom through the pipe that also connects to the range, and at the top with the pipe that supplies hot water to the house. This heater is so constructed that when the current is turned on it will in a few minutes begin to discharge water at about 180° in the top of the boiler, drawing its supply from the bottom of the boiler, so that in a short time after the heater is turned on there is but a small portion of the water in a large boiler unheated.

The maximum current demand for this heater is 2 KW., and when applied to the boiler in this manner it is said to make the boiler more efficient in the case of quick delivery of warm water than when the range is in operation. The current demand on the station is within reasonable limits, and for all practical purposes meets the average household demands.

The heater is arranged with three heat divisions, so that 500, 1,000 or 2,000 watts may be used as desired. Where a considerable amount of hot water is required, the maximum heat may be turned on for a limited time, and then the temperature of the boiler kept up with the low heat. Where a large quantity is not desired, merely such as is needed about the kitchen for the ordinary requirements, a short period of the use of the maximum heat enables the supply to be provided at low cost.

The feature of construction of the heater, which contributes to its efficiency in a large measure, is the fact that the enamel, the heater and the tube are practically homogeneous, so that the heat is conducted directly to the water through the shortest possible path from the wires embedded in the enamel. This feature insures the quickest possible conduction of the heat generated to the water. Another feature of construction is the control of the circulation which insures the delivery of high-temperature water, thereby permitting hot water to be drawn in a short period after turning on the current, while utilising all present house plumbing in the normal way and yet without having to heat up the entire contents of the boiler.

In practice, in the ordinary home, even at lighting rates, where care is used, the total cost for the use of this heater during such occasional intervals as it may be required in the summer time need never be large, or reach a point which would make its use prohibitive. The installation of the heater involves but a small job for the plumber and electrician, so that the total cost of the equipment is quite moderate. The device is 3 in. in diameter, 33 in. long, with $\frac{3}{4}$-in. couplings on either end. All of the outer portions are nickel-plated brass. For connecting to the circuit it is provided with a plug switch and flexible conductor.

The Territorial Electricals.—From Tuesday's *London Gazette* we cull the following announcement concerning appointments of electrical and telegraph engineers in the Territorial Army:—

ROYAL ENGINEERS.

Welsh Divisional Telegraph Company, Welsh Divisional Engineers; William Arnold to be Second Lieutenant. Dated May 29th, 1908.

London District Telegraph Companies, Royal Engineers (Army Troops); Major (Honorary Major in the Army) Andrew Bain, M.Inst.C.E.I., M.Inst.E.E., from the London Division (Electrical Engineers) Royal Engineers (Volunteers), to be Lieutenant-Colonel. Dated April 1st, 1908.

London Wireless Telegraph Company, London District Telegraph Companies, Royal Engineers (Army Troops); the undermentioned officers, from the London Division (Electrical Engineers) Royal Engineers (Volunteers), are appointed to the Company, with rank and precedence as in the Volunteer Force. Dated April 1st, 1908:—

Captain (Honorary Captain in the Army) Edward Hunlington Leaf, A.M.Inst.C.E.

Lieutenant Selwyn Wollaston Humphery, A.M.Inst.E.E.

London Cable Telegraph Company, London District Telegraph Companies, Royal Engineers (Army Troops); Supernumerary Captain (Honorary Captain in the Army) John Joseph Francis O'Shaughnessy, M.Inst.E.E., from the London Division (Electrical Engineers) Royal Engineers (Volunteers), to be Major, remaining seconded. Dated April 1st, 1908.

Captain (Honorary Captain in the Army) James Edward Pearce, from the London Division (Electrical Engineers) Royal Engineers (Volunteers), to be Major. Dated April 1st, 1908.

Captain and Honorary Major (Honorary Lieutenant in the Army) George Bransby Williams, A.M.Inst.C.E., A.M.Inst.E.E., from the London Division (Electrical Engineers) Royal Engineers (Volunteers), is appointed Captain with the honorary rank of Major, with precedence as in the Volunteer Force. Dated April 1st, 1908.

Second Lieutenant Charles William Zoephel, A.M.Inst.E.E., from the London Division (Electrical Engineers) Royal Engineers (Volunteers), to be Lieutenant. Dated April 1st, 1908.

London Air-line Telegraph Company, London District Telegraph Companies, Royal Engineers (Army Troops); Captain John Henley Shawe Phillips, A.M.Inst.E.E., from the London Division (Electrical Engineers) Royal Engineers (Volunteers), to be Major. Dated April 1st, 1908.

The undermentioned officers, from the London Division (Electrical Engineers) Royal Engineers (Volunteers), are appointed to the Company, with rank and precedence as in the Volunteer Force. Dated April 1st, 1908:—

Captain (Honorary Captain in the Army) Harry Fowler Bigge.

Second Lieutenant Frederick Hill Masters.

Second Lieutenant Herbert Charles Gunton.

Lieutenant Eustace Graham Sheppard, A.M.Inst.E.E., from the London Division (Electrical Engineers) Royal Engineers (Volunteers), to be Captain. Dated April 1st, 1908.

Scottish Command Telegraph Companies, Royal Engineers (Army Troops); the undermentioned officers, from the 1st Lanarkshire Royal Engineers (Volunteers), are appointed to the Companies, with rank and precedence as in the Volunteer Force. Dated April 1st, 1908:—

Lieutenant-Colonel and Honorary Colonel James Smith Park, M.V.O.

Lieutenant-Colonel and Honorary Colonel David Laidlaw, jun. (To be supernumerary.)

Lieutenant-Colonel and Honorary Colonel James S. Park, M.V.O., resigns his commission, with permission to retain his rank, and to wear the prescribed uniform. Dated May 28th, 1908.

Supernumerary Lieutenant-Colonel and Honorary Colonel David Laidlaw, jun., to be Lieutenant-Colonel. Dated May 28th, 1908.

Municipal Favouritism.—A sequel to the recent appointment of an apprentice in the borough electrical engineer's department was seen at the meeting of the Morecambe T.C. on Thursday last week, when Councillor Christie brought forward a resolution "that, in order to give engineers employed by the Council that freedom of action necessary for the administration of their respective departments, the Council considers it undesirable that members having sons or near relatives employed in any of those departments should seek re-election." His object, he contended, was for the promotion of civic purity. Where sons of Councillors occupied positions, they had advantages over outsiders,

and referring particularly to the Corporation Electric Light Department, he considered it was not right for a Councillor's son to be taken as apprentice unless the Councillor offered to contest his seat again. Their electrical engineer, he concluded, had not that amount of freedom which he otherwise would have. After a long and heated discussion, the motion was rejected by 9 votes to 3.

High-Resistance Break Test.—In the recent issues of the Electrical Review will be found a revised description of the Rymer-Jones high-resistance break test, which we are reprinting in pamphlet form. The theoretical considerations on which this test is based, and the *modus operandi* are fully explained, and several practical examples of actual break localisations given. The accuracy of the results shows that this test effectually meets an important want, by providing submarine cable electricians with a simple method of localising what has hitherto been the most difficult and unmanageable of all faults, viz., breaks having a resistance too high to be entirely broken down, and too low to be scaled up for correct localisation by existing methods, which are quite inapplicable to this kind of fault.

Refuse Destruction.—On 21st inst. a deputation from the Paris Municipal Council visited the Greenock destructor undertaking, recently described in our pages, also the Glasgow refuse and destructor works, in connection with their inquiry into the subject of city refuse disposal in the United Kingdom.

Educational Notes.—The Hackney Institute.—The prospectus of classes at this Institute, in engineering, physics and electrical engineering, mathematics, chemistry, &c., for the coming session has just been issued by the Principal, Mr. Percy Kirk.

University College.—Full particulars of the courses in mechanical, civil, municipal and electrical engineering to be given in the session which opens on October 5th, appear among our "Educational Notices" to-day.

Appointments Vacant.—Fourth assistant engineer for the Hammersmith B.C. electricity department (£130); assistant electrical foreman for the East Indian Railway Co. See our "Official Notices" to-day.

Electric Shock Fatalities.—An inquest was held last Saturday into the death of Edwin Dale (19), of Bedworth Works, who a few days previously was found dead near an electric motor at the Exhall Colliery, Nuneaton. On the coroner's instruction the jury viewed the body a second time, as it was absolutely necessary that it should be thoroughly examined for any visible marks causing death. According to a report in the *Birmingham Gazette*, Matthew Spilsby said he found the body at the back of the motor, lying between it and the switchboard. Walter Beasley, electrician, said that the motor was properly insulated. William Randle said the dead man was well acquainted with electric motors and their working, and instructions had been given for all the men to keep clear of the "live" parts of the electrical installation. Dr. L. Orton said that he found death was due to syncope. A post mortem examination revealed nothing further. He could not say that death was definitely due to electric shock. There were no signs of burns. The jury retired, and on returning into court half-an-hour later returned a verdict to the effect that death was due to an electric shock.

The *Morning Leader* states that a young man has been killed near Basle while flying a kite to which an aluminium wire was attached, instead of the customary string. Without his knowledge the wire came in contact with a high-tension conductor, and the kite owner was killed on the spot.

At Bolton, on Tuesday, an inquest was held on Thomas Brindle (27), of 17, Victoria Street, who, whilst working at an electrical machine at the engineering works of Messrs. Dobson & Barlow, Ltd., Kay Street, suddenly collapsed.

Dr. James Scott, senior house surgeon at the Infirmary, said the post-mortem examination revealed a recent burn on the lower part of the body. Apart from the history of the case, there was nothing to indicate the cause of death.

The Coroner: The only evidence you have of any electric shock is the external burn?—Yes.

Was the man's clothing burned near the mark on his body?—No.

Can you account for his body being burned and not his clothing?—It is quite compatible with electricity.

Peter Hamer, blacksmith, said deceased worked under him in the foundry. On Saturday morning they were at the electric welding machine, and a long bar of iron was in the machine. Brindle took hold of the bar while the current was on the machine, and there was a cry, "Knock it off—he's falling!" The current was at once shut off, but Brindle was unconscious. A board was provided for those using the machine to stand upon, and in that way to prevent an electric circuit being formed. Brindle seemed to have had one foot off the board and against ironwork below it.

A verdict of "Accidental death" was returned.

It was stated, on behalf of Messrs. Dobson & Barlow, that the firm extremely regretted the unfortunate occurrence, which was the first of its kind at their works.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station Officials.—On Monday last the marriage of Mr. Gordon Bryant, A.M.I.E.E., borough electrical engineer of Great Yarmouth, and Miss Beatrice Hart, was celebrated at the St. Nicholas Church. Mr. and Mrs. Bryant left the town during the day by motor launch for the Norfolk Broads.

The successful candidate for the post of charge engineer at the Eastbourne electricity works is Mr. J. Randall Goodall, of the Woolwich Electricity Department.

On the occasion of his approaching marriage, Mr. G. P. Cosway, chief assistant engineer, was presented by the electricity works staff at Nuneaton with a marble clock, suitably inscribed. Mr. S. Cameron Gibson, borough electrical engineer, made the presentation.

General.—Mr. Louis W. Smith has resigned his position as works manager for Messrs. Richard Garrett & Sons, Ltd., Leiston; he has taken an active position in the works management, and will shortly join the board of directors of Messrs. W. Sisson & Co., Ltd., Gloucester, marine and high-speed engine builders, but he will continue to represent Messrs. R. Garrett & Sons in the West of England in threshing and road haulage tackle.

The President of the Board of Trade has appointed Major W. A. J. O'Meara, R.E., C.M.G., to be an additional British Delegate to the International Conference on Electrical Units and Standards, which is to assemble in London on October 12th.

Obituary.—Sir Eyre Massey Shaw, late chief of the Metropolitan Fire Brigade, whose death is announced this week, was a director of the Metropolitan Electric Supply Co., Ltd.

M. Henri Becquerel.—We regret to announce the death, which occurred in Brittany at the age of 58 years, of M. Henri Becquerel the eminent physicist whose researches in radio-activity led to the Nobel Prize being conferred upon him in 1903. Among the numerous honours and awards conferred upon him was the Royal Society's Rumford medal received by him in 1900. The late M. Curie studied under Becquerel.

M. E. E. Mascart.—We deeply regret to learn from the Press of yesterday that M. Mascart, who was one of the early pioneers in certain branches of electrical research, terrestrial electricity and magnetism, and in meteorology, has passed away. Since 1878, up to last year, he had been director of the Central Bureau of Meteorology in France. He was born in 1837. The Institution of Electrical Engineers made him an Honorary Member in 1901.

NEW COMPANIES REGISTERED.

Lind & Co., Ltd. (99,275).—This company was registered on August 21st, with a capital of £5,000 in £1 shares, to acquire the business of an electrical manufacturers' agent, general electrician and contractor carried on by A. L. Lind and G. St. J. Wood, at 37, Moorfields, Liverpool, as Lind & Co. The subscribers (with one share each) are:—A. L. Lind, 5, Cecil Road, Prenton, Cheshire, electrical engineer; G. St. J. Wood, 4, Buckingham Avenue, Claughton, Birkenhead, electrical engineer; J. G. Wilson, 12, London Street, Liverpool, traveller. Private company. The first directors are A. L. Lind, G. St. J. Wood and J. G. Wilson. Registered office, 37, Moorfields, Liverpool.

Arthur Koppel Aktien-Gesellschaft (90 F.).—Particulars filed August 5th. Registered in Germany in January, 1905, with capital 10,000,000 marks in shares of 1,000 marks each, to acquire the business of Arthur Koppel, and to carry on the business of manufacturers of railway materials and tools, &c. British address, 27, Clements Lane, E.C., where F. H. Leistekow is authorised to accept service.

Sao Paulo Tramway, Light and Power Co., Ltd. (183 F.).—Particulars filed August 17th. Registered in Ontario, Canada, in 1899, as the "Sao Paulo Railway, Light and Power Co." Re-named in 1899. Capital $7,500,000 in shares of $100 each. British address, 34, Nicholas Lane, E.C., where J. Davidson is authorised to accept service.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Wolverhampton District Electric Tramways, Ltd. (68,345).—This company's annual return was filed on June 18th, when 32,200 shares had been taken up out of a nominal capital of £200,000 in £5 shares. £5 per share has been called up on 31,950, and 5s. per share on 252, and £159,812 10s. has been received. Mortgages and charges: £100,000.

Northwood Electric Light and Power Co., Ltd. (66,312).—This company's annual return was filed on July 29th, when 12,357 ordinary, and 6,730 preference, had been taken up out of a nominal capital of £30,000 in 15,000 ordinary, and 15,000 preference shares of £1 each. £1 per share has been called up on 8,182 ordinary, and 6,730 preference, and £14,862 has been received. £4,225 is considered as paid on 4,225 ordinary. Mortages and charges: Nil.

Underground Electric Railways Co., of London, Ltd. (73,576).—A trust deed dated July 30th, 1908, securing (1) prior lien bonds not exceeding £1,000,000 (unless same be increased as provided in conditions endorsed thereon to £1,250,000), (2) 4½ per cent. bonds of 1933, securing not more than £3,000,000, and (3) 6 per cent. income bonds, securing not more than £5,300,000 (all created by resolution of July 30th, 1908), has been registered. Property charged: (a) Stocks and shares of various electric railway and tramway companies, amounting in all to £11,079,990 (known as the "appropriated assets"); (b) shares in three tube railways, amounting in all to £3,500,000; (c) freehold power house and other buildings at Chelsea, with plant, &c., thereon, cable subway therefrom to near Earl's Court Station, &c.; and (d) rights under various contracts. Trustees: London and Westminster Bank, Ltd., Lothbury, E.C. Commissions, discounts, &c.: (1) For underwriting £1,000,000 prior lien bonds, £25,000, with ½ per cent. brokerage on nominal value; (2) for procuring or agreeing to procure subscriptions for said issue of £1,000,000 prior lien bonds, brokerage of ½ per cent. on amounts allotted in response to such applications from shareholders and holders of profit-sharing secured notes as are handed in by brokers; (3) under scheme of arrangement, holders of £7,000,000 profit-sharing secured notes exchange their notes as to 40 per cent. of nominal value into 4½ per cent. bonds of 1933 at par, and as to 70 per cent. of nominal value into 6 per cent. income bonds at par, exchange taking place as on December 1st, 1907; (4) company has agreed to sell 4½ per cent. bonds of 1933 and 6 per cent. income bonds at rate of £900 and accrued interest on 4½ per cent. bonds for £900 (nominal) of 4½ per cent. bonds and £300 (nominal) of income bonds (taken together); total amount which may thus be sold limited to £200,000 (nominal) of 4½ per cent. bonds of 1933 and £300,000 (nominal) of income bonds.

Ilfracombe Electric Light and Power Co., Ltd. (71,378).—This company's annual return was filed on June 22nd, when 67 shares had been taken up out of a nominal capital of £15,000 in £5 shares. £335 has been received. Mortgages and charges: Nil.

Durham Collieries Electric Power Co., Ltd. (83,421).—Amended return filed August 10th, of a charge dated July 15th, 1908, states that the holders thereof are the Trustees, Executors and Securities Insurance Corporation, Ltd., of Winchester House, E.C. The word "Securities" was omitted from the previous return, which read "Trustees and Executors Insurance Corporation, Ltd."

Rye and Camber Tramways, Ltd. (43,800).—Particulars of £700 debentures created by resolution of April 24, 1908, have been filed pursuant to Sec. 10 (3) of the Companies' Act, 1907, the amount of the present issue being £60. Property charged: General assets. No trustees.

Guildford Electricity Supply Co., Ltd. (36,725).—Re-issue on August 6th of £500 debentures, part of a series of which particulars have already been filed.

Oxford Electric Co., Ltd. (34,685).—A statement of the total amount outstanding on July 1st in respect of mortgages and charges created prior to that date and not required to be registered under Sec. 14 of the Companies' Act, 1900, has been filed pursuant to Sec. 12 of the Companies' Act, 1907. Particulars: Trust deed dated July 21st, 1897, securing £50,000.

Venezuela Telephone and Electrical Appliances Co., Ltd. (81,305).—A statement of the total amount outstanding on July 1st in respect of mortgages and charges created prior to that date and not required to be registered under Sec. 14 of the Companies' Act, 1900, has been filed pursuant to Sec. 12 of the Companies' Act, 1907. Particulars: Mortgages or charges dated July 28th, 1890, and April 7th, 1893, securing £88,500.

Pacific and European Telegraph Co., Ltd. (86,683).—A statement of the total amount outstanding on July 1st in respect of mortgages and charges created prior to that date, and not required to be registered under Sec. 14 of the Companies' Act, 1900, has been filed pursuant to Sec. 12 of the Companies' Act, 1907. Particulars: Debentures dated November 17th, 1892, securing £99,400 (£100,000 authorised).

West Coast of America Telegraph Co., Ltd. (52,114).—A statement of the total amount outstanding on July 1st in respect of mortgages and charges created prior to that date and not required to be registered under Sec. 14 of the Companies' Act, 1900, has been filed pursuant to Sec. 12 of the Companies' Act, 1907. Particulars: £150,000 4 per cent. debentures and £20,000 4 per cent. income bonds, dated April 28th, 1897.

South London Electric Supply Corporation, Ltd. (50,392).—Mortgage dated February 5th, 1907, stamped to cover £80,000, was registered on August 1st, 1908, pursuant to order of Court. Property charged: Certain freehold hereditaments near Denmark Hill, and all purchase money payable to mortgagees in the event of any sale or transfer of undertaking or part thereof. Holders: National Provincial Bank of England, Ltd., 112, Bishopsgate Street Within, E.C.

Ackroyd & Best, Ltd. (54,600).—Particulars of £15,000 debentures created by resolution of March 3rd, 1904, and secured by a trust deed dated July 2nd, 1904 (supplemental to deeds of 1900 and 1903), have been filed pursuant to Sec. 10 (3) of the Companies' Act, 1907, the amount of the present issue being £500. Property charged: The company's undertaking and property, present and future, including uncalled capital. Trustees: C. T. Naylor, of Alresford, Hants, and J. P. Humble, of Wortley, Leeds.

British Accumulator Co., Ltd. (79,191).—This company's annual return was filed on July 2nd, when the entire capital of £5,000 in £1 shares had been taken up. £2,500 has been received, and £2,500 is considered as paid. Mortgages and charges: Nil.

South African Lighting Association, Ltd. (27,609).—This company's annual return was filed on July 17th, when 8,905 shares had been taken up out of a nominal capital of £100,000 in £10 shares. £1,050 has been received and £80,008 is considered as paid. Mortgages and charges: £30,000.

Keynsham Electric Light and Power Co., Ltd. (64,634).—Particulars of £1,500 second mortage debentures, created by resolution of October 9th, 1905, have been filed pursuant to Sec. 10 (3) of the Companies' Act, 1907, the amount of the present issue being £350. Property charged: The company's undertaking and property, present and future, including uncalled capital, if any (subject to first mortage debentures), and land and premises at Keynsham. No trustees.

South African Lighting Association, Ltd. (27,609).—Particulars of £20,000 debentures created by resolution of August 12th, 1890, have been filed pursuant to Sec. 10 (3) of the Companies' Act, 1907, the amount of the present issue being £5,000. Property charged: The company's undertaking and property. No trustees.

Birmingham and Midland Tramway, Ltd. (19,077).—A statement of the total amount outstanding on July 1st in respect of mortgages and charges created prior to that date and not required to be registered under Sec. 14 of the Companies' Act, 1900, has been filed pursuant to Sec. 12 of the Companies' Act, 1907. Particulars: Mortgage dated 1903, securing £4,750.

"X" Syndicate, Ltd.—(97,434).—(Electricians, London).—Particulars of £3,700 debentures created by resolution of July 23rd, 1908, have been filed pursuant to Sec. 10 (3) of the Companies' Act, 1907, the whole amount being issued on same date. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

CITY NOTES.

Mersey Railway Co.

For the half-year ended June 30th the directors report that the train mileage run was 408,134 miles, as compared with 411,313 during the corresponding six months of 1907. The number of passengers conveyed has been 5,719,572, as against 5,618,462 for 1907, exclusive of season ticket holders. The total receipts from all sources for the half-year have been £51,784, as compared with £49,892 for the corresponding period of 1907. The working expenses, exclusive of the charges for pumping, ventilation, and lifts, have been £33,075 equal to 63·87 per cent., as against £31,418, equal to 62·97 per cent. for the corresponding six months. These charges for pumping, ventilation, and hydraulic lifts, for the past half-year amounted to £4,070, equal to 7·86 per cent., as compared with £4,059, or at the rate of 8·13 per cent. for the corresponding period of 1907.

Dublin and Lucan Electric Railway Co.

The half-yearly meeting was held on 20th inst. at Dublin, Mr. W. Mooney, J.P., presiding.

The Chairman, in moving the adoption of the report, said that the working of the line continued satisfactory. The gross receipts for the half-year have been £3,108, as against £2,897 for the corresponding period of 1907, equivalent to 13⅜ per cent. on the receipts, but the expenditure had increased by £247, of which no less than £187 was in the item of coal. When it was borne in mind that £150 was sufficient to pay a dividend of 1 per cent. for the half-year on the ordinary shares, it would be seen how severely it affected them. The causes that had operated to prevent the directors, for several years past, from declaring a dividend on the ordinary shares, he had often explained, but they were:—First, the expense entailed upon the company by the construction of an entirely new line on a raised platform, the electrifying of the system, and the providing of new rolling stock to meet the altered state of circumstances. The capital necessary for those purposes, in addition to a substantial contribution out of current revenue, was provided by the issue of debentures, and of 5 per cent. preference shares, the entire sum more than doubling the then issued capital of the original undertaking. The sum thus contributed out of revenue since the opening of the new electric line in 1900 had exceeded £3,600. In addition to making these large capital payments out of revenue, they had paid the debenture interest and the dividend on the preference shares, and maintained the permanent way and rolling stock in first-class order, while the only payments that now remained to be paid out of revenue, beyond the ordinary current outgoings, were the sum of £750 and interest still due on electrical equipment account, and the temporary indebtedness to the bankers, both of which demands appeared on the present balance-sheet.

The report was adopted. It was resolved that a dividend at the rate of 5 per cent. per annum be declared on the preference shares for the six months ended June 30th.

Stock Exchange Notices.—Application has been made to the Committee to allow the following securities to be quoted in the Official List:—

Rio de Janeiro Tramway, Light and Power Co., Ltd.—$456,600 additional first mortgage 30-year 5 per cent. gold bonds, Nos. 53,001 to 55,295 and 75,225 to 77,000 for $100, and 29,490 to 29,600 for $500 each.

The Committee have appointed special settling days as under:—

Wednesday, September 2nd.—Anglo-Argentine Tramways Co., Ltd.—£555,000 4 per cent. debenture stock.

And ordered the undermentioned securities to be quoted in the Official List:—

Anglo-Argentine Tramways Co., Ltd.—£555,000 4 per cent. debenture stock.
Metropolitan Electric Tramways, Ltd.—391,337 ordinary shares of £1 each, fully paid, Nos. 1 to 391,337.
Morgan Crucible Co., Ltd.—Further issue of 15,000 5½ per cent. cumulative second preference shares of £10 each, £8 paid, Nos. 15,001 to 30,000.

Manganese Bronze and Brass Co.—Referring to the passing of the interim dividend on the ordinary shares, the directors, after announcing the declaration of the usual dividend at the rate of 6 per cent. per annum, less income-tax, on the preference shares for the half-year ended June 30th last, state (according to the *Financial Times*), that in view of the present slackness in the shipbuilding world, they have decided not to pay an interim dividend on the ordinary shares, but to await the result of the full financial year before making any distribution. They, however, state that the trading profit for the six months ended June 30th has been quite satisfactory, and exceeds the average for the last five years.

Aberdeen Suburban Tramways Co.—The profit earned for the half-year by this company amounts to £835, making, with the sum carried forward from last half-year, a balance of £2,423 at the credit of profit and loss account. The profit is larger than that earned in any corresponding half-year since the company started business. The directors recommend placing £1,000 to renewal and depreciation account, the payment of a 2 per cent. dividend, the payment of £42 as directors' fees, and the carrying forward of £755.

Cambridge Electric Supply Co., Ltd.—An interim dividend of 5 per cent. per annum (4s. 6d. per share), less income-tax, is announced for the half-year.

ELECTRIC TRAMWAY AND RAILWAY TRAFFIC RETURNS.

Locality.	Fortnight ended.	Receipts for the fortnight. £	Receipts for the fortnight. £*	No. of wks.	Total to date. £	Total to date. £*	Route miles open.	Inc.
Aberdeen	Aug. 19	3,304	+ 3	12	18,623	+ 13	14·4	..
Ayr	,, 22	1,003	— 69	14	6,088	— 21	8	..
Bath	,, 22	1,831	— 416	33	24,391	— 1,494	13	..
Belfast	,, 21	7,198	— 1	21	75,887	..	37	..
Birkenhead	,, 23	2,154	+ 8	21	22,768	+ 619	18·5	..
Birmingham Corp.	,, 15	12,489	— 282	20	125,770	+ 5,251	56·5	..
Blackburn	,, 12	2,413	+ 19	20	23,697	+ 1,161	14·12	..
Blackpool Corp.	,, 20	5,951	— 388	..	29,491	+ 510	11·87	..
,, —Fleetw'd.	,, 22	3,956	— 278	7	11,854	— 432	8·25	..
Bolton	,, 23	4,804	+ 102	21	50,320	+ 1,248	42	..
Bournemouth	,, 19	4,784	— 237	20½	35,849	— 1,898	21·7	..
Bradford	,, 15	10,416	+ 201	19	95,799	+ 1,092	54·9	1
Brighton	,, 23	2,537	+ 142	21	21,106	..	9·5	..
Bristol	,, 21	9,078	+ 112	..	..	..	12·21	..
Brit. Elec. Trac. Co.								
Airdrie	,, 14	423	— 12	32	7,159	+ 77	3·65	..
Barnsley	,, 14	388	— 36	,,	5,647	+ 295	..	..
Barrow	,, 14	646	— 94	,,	7,984	— 268	5·37	..
Cavehill	,, 14	266	+ 77	,,	2,987	+ 215	..	..
Devonport	,, 14	1,184	+ 117	,,	14,805	+ 116	8·85	..
Gateshead	,, 14	2,117	— 91	,,	32,471	+ 190	11·25	..
Gravesend	,, 14	581	— 100	,,	6,851	— 994	6·5	..
Greenock	,, 14	1,261	— 132	,,	17,155	— 4,217	7·25	..
Hartlepool	,, 14	677	— 21	,,	7,735	— 1,509	6·72	..
Kidderminster	,, 14	454	— 30	,,	3,734	— 153	..	..
Leamington	,, 14	533	+ 40	,,	5,422	+ 358	3	..
Merthyr	,, 14	501	— 5	,,	6,802	+ 81	2·9	..
Metropolitan	,, 14	14,581	+2,583	,,	183,543	+36,155	22	..
Middleton	,, 14	888	+ 71	,,	11,794	+ 460	8·5	..
Mid. Joint Com'tee	,, 14	13,371	— 297	,,	185,858	— 1,113	..	..
Oldham—Ashton	,, 14	1,281	— 89	,,	19,188	— 176	9·18	..
Peterborough	,, 14	362	— 38	,,	4,117	+ 53	5·31	..
Potteries	,, 14	3,650	— 252	,,	58,620	— 744	29	..
Rotherham	,, 14	1,254	+ 90	,,	7,096	— 197	2·75	..
Southport	,, 14	971	— 55	,,	9,216	— 433	8·17	..
S. Metropolitan	,, 14	2,440	— 32	,,	26,077	+ 649	..	..
Swansea	,, 14	2,724	+ 161	,,	30,361	+ 2,017	5·5	..
Tynemouth	,, 14	1,044	+ 5	,,	7,459	— 489	3·75	..
Weston-s-Mare	,, 12	1,145	+ 84	,,	4,415	+ 69	3	..
†Worcester	,, 14	818	— 25	,,	9,041	— 1	5·75	..
Wrexham	,, 14	246	— 7	,,	3,276	+ 7	..	..
Yorks. Wool. Dist.	,, 14	1,954	— 103	,,	29,570	— 1,251	17	..
Miscellaneous	,, 14	572	— 47	,,	6,640	— 538	..	..
†Burnley	,, 22	1,287	+ 5	..	..	..	7·5	..
Burton-on-Trent	,, 23	562	— 86	21	5,843	— 499	10	..
Bury	,, 23	2,456	+ 65	21⅝	25,644	+ 1,893	22·5	..
Cardiff	,, 15	6,055	+ 198	20	44,644	— 558	..	..
Carlisle	,, 22	405	+ 18	34	5,901	+ 37	..	..
Chatham and Dist.	,, 20	1,833	+ 217	33	25,288	+ 970	15	1·8
Cork	,, 20	1,075	+ 28	33	15,284	— 453	9·9	..
Croydon	,, 21	2,461	+ 1	21	30,908	+ 210	11·25	..
Darlington	,, 15	386	— 42	21	4,199	— 310	..	..
Darwen	,, 21	647	+ 10	37	5,387	— 20	4·36	..
Dover	,, 15	656	— 25	20	4,795	— 108	4 75	..
Dublin	,, 21	11,448	—3,783	..	43,912	—12,221	54·25	5·5
Dundee	,, 5	2,574	+ 372	11⅝	14,615	+ 1,114	14·5	..
East Ham	,, 22	1,818	+ 4	21	18,405	— 928	8	..
Exeter	,, 21	731	— 9	21	6,890	— 140	5·5	..
Glasgow	,, 22	33,860	— 806	14	204,092	+ 509	89·5	·5
Hastings	,, 20	3,416	— 79	..	..	..	..	..
Huddersfield	,, 22	3,482	— 89	21	34,580	+ 319	28·5	·5
Hull	,, 22	4,780	— 150	21	50,592	+ 104	13	..
Ilkeston	,, 20	291	— 2	20	2,960	+ 47	3·5	..
Ipswich	,, 22	982	— 47	21	8,817	— 162	10·5	..
Kilmarnock	,, 15	309	— 1	13	2,182	— 159	4·25	..
Lan'kshire Trm. Co.	,, 20	2,643	— 3	33	42,908	+ 3,787	17	1·2
Lancashire United	,, 19	3,155	+ 259	33	44,374	+ 2,323	39	1
Leeds	,, 22	14,223	— 664	21	142,109	— 4,723	96·75	·25
Leicester	,, 22	4,201	— 180	..	..	..	..	..
Leith	,, 15	1,176	+ 30	13⅔	7,661	+ 26	6	..
Liverpool	,, 15	22,574	—3,381	33	351,415	— 6,660	104	..
‡L.C.C.	,, 8	75,092	+9,574	16⅔	653,795	+72,621	121½	..
London United	,, 15	16,292	+ 730	..	217,145	+ 4,104	..	..
Lowestoft	,, 22	960	+ 18	47	9,243	+ 168	3·5	..
Manchester	,, 22	29,833	— 928	21	320,177	+12,092	89·5	11
Newcastle	,, 22	7,314	— 448	21	81,915	— 5,480	..	..
†Newport	,, 22	648	— 40	21	14,431	— 910	14·5	..
Northampton	,, 21	941	+ 30	20⅔	10,068	+ 661	5·5	..
Oldham	,, 23	4 086	+ 4	22	43,786	+ 738	14·75	..
Pontypridd	,, 22	760	+ 256	21	7,737	+ 4,117	5	1·75
Portsmouth	,, 23	5,606	+ 290	21	45,603	+ 750	14·5	..
Preston	,, 12	1,639	+ 78	..	..	..	..	..
†Reading	,, 20	667	— 24	20	13,245	+ 278	13·25	..
Rotherham	,, 20	1,259	— 56	20⅔	12,644	+ 133	10	·66
Salford	,, 24	9,379	— 114	19⅔	96,496	+ 2,442	38·9	..
Sheffield	,, 25	10,856	— 448	22½	122,150	— 444	37	1·25
South Shields	,, 22	1,225	— 45	..	12,176	— 204	..	..
Southampton	,, 19	2,434	+ 118	20	22,945	+ 1,651	..	..
Southend-on-Sea	,, 19	1,687	+ 198	21	10,055	+ 745	..	..
†Swindon	,, 12	181	— 24	..	..	..	4·4	..
Tyneside	,, 19	908	— 65	7	8,188	— 377	3·67	..
Wallasey	,, 22	2,039	+ 109	22½	19,570	+ 922	8·72	·22
†Walthamstow	,, 15	694	— 10	20	13,317	+ 1,017	9	..
West Ham	,, 18	4,928	— 85	20	45,350	— 2,543	14·7	..
†Wolverhampton	,, 19	878	— 47	20	17,793	— 272	12·5	..
Baker St.-Waterloo	,, 22	5,230	+1,150	8	22,680	+ 4,070	4·25	1
Cen. London Rly.	,, 22	13,059	+4,489	8	56,017	+16,561	5·77	..
Char. +, Eus. Hamp.	,, 22	5,975	+1,385	8	25,890	+ 5,525	7·76	..
City & S. Lon. Rly.	,, 23	5,756	— 128	8	23,298	— 1,379	7·3	1·05
Dublin-Lucan Rly.	,, 21	885	— 1	7	1,318	— 36	7	..
G.N. and City Rly.	,, 23	2,379	— 559	8	10,327	— 2,380	3·5	..
G.N., P'dy. & Brmtn.	,, 22	8,560	+1,645	8	39,030	+ 7,855	9·25	·25
L'pool Overh'd Rly.	,, 23	2,976	— 111	..	11,966	— 1,807	6·3	4·3
Mersey Railway	,, 22	3,698	+ 54	3	14,730	+ 139	4½	..
†Metropolitan Rly.	,, 16	14,695	+ 808	..	109,880	+ 4,028	24·5	..
Met. District Rly.	,, 22	16,089	+2,683	8	69,942	+10,417	24	..
Anglo-Argentine	,, 19	46,192	+13,728	24	545,283	+101,966	42	..
§Auckland	July 17	11,910	+1,743	28½	82,579	+ 8,873	20·92	1·72
Bombay (B.E.T.)	,, 30	4,951	+ 912	30	71,134	+13,945	..	..
§Brisbane	July	14,026	+1,251	..	..	..	..	..
†Buenos A. & Belgr'o.	July 1	3,664	+ 507	26	96,675	+ 1,116	..	..
Calcutta	Aug. 22	6,892	+ 133	..	..	..	..	..
§Geneva	June	8,804	+ 464	..	..	..	..	..
§Kalgoorlie, W.A.	July	3,674	..	..	25,729	..	30·5	..
Madras	July. 31	1,231	+ 89	30	17,492	+ 1,582	13·75	..
Montevideo	June	16,519	+2,597	52	160,490	+24,458	..	..
†Perth (W.A.)	Aug. 21	1,347	— 26	34	46,953	— 902	26	..

Compared with the corresponding period of 1907. † One week only.
‡ Includes horse, steam and other receipts. § One month.

STOCKS AND SHARES.

Tuesday Evening.

More activity is discernible in certain of the investment markets of the Stock Exchange, and prices show a little inclination to advance. This can be seen, for example, in the telegraph section, where the best sort of securities continue their steady improvement. The lassitude of the Home Railway market is a more unpleasant feature.

Baker Street and Waterloo 4 per cent. Debenture is 1 better at 93, but this is the only rise in electrical railway stocks to record. Piccadilly and Charing Cross Debenture stocks hold their gains at 92 and 83 respectively, but in the list of Ordinary issues several declines have occurred. Metropolitans fell to 35½ and Districts to 11, a drop of ½ apiece. Central London Ordinary and Deferred are 1 and 2 points down respectively, the latter having 49 for its lower price, and this in spite of good traffics.

Some official announcement on the subject of whether the Franco-British Exhibition will be opened in coming years would meet a generally expressed want. While it is taken for granted that the show will become perennial, a definite statement would set at rest the doubt which still exists on the point.

The animation amongst Canadian and Mexican stocks goes on merrily, and prices continue to ascend. Mexican Light and Power Common stock at 78 exhibits a rise of 2, the 7 per cent. Preference stock remaining at 112½. The 5 per cent. gold bonds, however, slipped back to 90.

Mexico Tramways Common stock rose 5½ more points to 125½, Rio Trams are 1 better at 64, and Sao Paulo has put on 6 points at 156.

Before dealing in the bonds of these Canadian companies, it is well to ascertain whether the quotation is per cent. or per bond Mistakes and misapprehensions are common with regard to this matter, and the man who receives a contract worked out a little differently from what he expected is apt to think he has a grievance.

Other tramway and traction varieties are quiet. British Electric Traction shares are flat, and the 5 per cent. First Debenture lost a point, which it subsequently regained. Calcutta Trams are ¼ better at 5⅝, and Calcutta Electric Supply shares rose to 6¼, after being 6½, there appearing to be a recovery of confidence in Indian investment, with Government securities leading.

In the list of home electricity supply descriptions, Newcastle-on-Tyne 5 per cent. Preference are another 2s. 6d. better at 5⅝, and the nature of the rise rather suggests that someone has been caught short of shares. The Ordinary, however, have lost 5s., County Preference gained ⅛, while Metropolitan Preference shed a similar fraction City Preference went up 5s., and Notting Hills are the same amount lower. Edmundson's 4½ per cent. Debenture stock has been marked up a point, and Urban Ordinary at 15s. are nominally 5s. down.

The improvement in telegraph stocks is common to nearly all the various groups, and about the only fall of the week is that of 2s. 6d. in Direct United States shares. On the other hand, Amazons have regained their loss of last week, Great Northerns are ½ better, Eastern Ordinary rose an equal amount, and several Debenture prices are up, the demand for gilt-edged issues being larger than the supply to meet it.

The telephone market has again displayed some considerable firmness, and there are quite a number of rises, considering the fewness of the stocks quoted. American Telegraph and Telephone capital stock is a point up, National Preferred, Deferred Debenture and Third Preference are better, and United River Plate Preference rose ⅛. Globe Telegraph and Trust shares retain their improvements.

Manufacturing quotations are mostly good. Babcock & Wilcox at 4 are 7/16 better, and the Preference at 1 5/16 are 1/16 up. General Electric 4 per cent. Debenture rose 2, the demand being apparently due to the company's success with metallic filament lamps. Cromptons, however, are lower, and a feeling of unrest still prevails in regard to further possible labour troubles. Henley's and Callender's Debenture stocks have not advanced in sympathy with the rise in Telegraph issues.

Calcutta Electric Supply Corporation, Ltd.—The number of units delivered to consumers during the five weeks ended July 31st, 1908, were 724,011, compared with 681,826 units in the corresponding five weeks of 1907.

Brighton and Rottingdean Seashore Electric Tramroad Co.—The report for the year ended December 31st, 1907, states that the balance of revenue was £2,132. As quoted in the *Financial Times*, it states that sundry creditors absorbed £714, debenture interest, £984, and the amount due to capital account was £434.

SHARE LIST OF ELECTRICAL COMPANIES.

TELEGRAPH AND TELEPHONE COMPANIES.

Present Issue.	NAME.	Stock or Share. *	Dividends for the last four years. 1904.	1905.	1906.	1907.	Closing Quotations August 18th.	Closing Quotations August 25th.	Business done week ended August 25th, 1908. Highest.	Lowest.	Rise + or Fall −	Present Yield per cent. £ s. d.
25,000	Amazon Telegraph Co.'s shares, Nos. 1 to 25,000	10	Nil	Nil	Nil	Nil	1¾ — 2¼	2 — 3	..	..	..	Nil
143,800	Do. do. 5 % Debs., Nos. 1 to 1,250 Red.	100	Nil	5 %	5 %	5 %	87 — 90	89 — 92	90	..	+2	5 12 4
$181,551,400	American Telephone & Telegraph, Cap. Stock	$100	7½%	7½%	8 %	8 %	125 —129	126 —130	130	..	+1	6 3 1
58,000,000	Do. Collat. Trust, 4% Bonds, 1 to 28,000 and 53,001 to 78,000	$1000	4 %	4 %	4 %	4 %	89 — 92	89 — 92	..	..	..	4 7 0
598,180	Anglo-American Telegraph	Stock	2¾%	3½%	3¾%	3½%	58 — 61	58 — 61	..	..	..	5 14 9
3,200,910	Do. do. do. 6 % Pref.	Stock	5½%	6 %	6 %	6 %	103½—104½	103½—104½	104½	103½	..	5 14 10
3,200,910	Do. do. do. Deferred	Stock	Nil	½%	1¾%	1 %	16 — 16½	16 — 16½	16⅝	16⅛	..	6 1 3
50,000	Anglo-Portuguese Tel., 5 % Mort. Deb. Stock Red.	100	..	5 %	5 %	5 %	101 —104	101 —104	..	..	..	4 16 2
44,000	Chili Telephone, Nos. 1 to 44,000	5	8 %	8 %	8 %	8 %	8 — 8½	8 — 8½	..	..	..	4 14 1
2,383,376	Commercial Cable Sting. 500 year 4 % Deb. Sk. Red.	Stock	4 %	4 %	4 %	4 %	84 — 87	84 — 87	85½	..	..	4 12 0
16,000	Cuba Telegraph	10	5 %	5 %	5 %	6 %	7⅞ — 8⅛	7⅞ — 8⅛	..	..	..	7 1 2
6,000	Do. 10 % Pref.	10	10 %	10 %	10 %	10 %	15⅜ — 16⅛	15⅜ — 16⅛	..	..	..	6 1 3
12,981	Direct Spanish Telegraph, Ord.	5	4 %	4 %	4 %	4 %	3 — 3½	3 — 3½	..	..	..	6 3 1
6,000	Do. do. 10 % Cum. Pref.	5	10 %	10 %	10 %	10 %	8 — 9	8 — 9	..	..	..	5 11 1
80,000	Do. do. 4½ % Debs.	50	4½%	4½%	4½%	4½%	100 —103	100 —103	..	..	..	8 14 10
60,710‡	Direct United States Cable	20	3½%	4½%	4¾%	4½%	13½—13⅝	13⅝—13⅞	13⅝	13½	— ⅛	6 4 10
50,900‡	Direct W. India Cable, 4½ % Reg. Deb., 1 to 1,200, R.	100	4½%	4½%	4½%	4½%	99 —101	99 —101	..	..	..	4 9 1
4,000,000	Eastern Telegraph, Ord. Stock	Stock	7 %	7 %	7 %	7 %	134½ —137½	135 —138	137	135½	+ ½	5 1 5
2,000,000	Do. 8½ % Pref. Stock	100	8½%	8½%	8½%	8½%	84 — 86	84 — 86	85⅞	84⅜	..	4 1 5
1,896,706	Do. 4 % Mort. Deb. Stock. Red.	Stock	4 %	4 %	4 %	4 %	101½ —103½	102 —104	103⅛	102½	+ ⅛	3 16 8
800,000	Eastern Extension, Australasia, and China Tele.	10	7 %	7 %	7 %	7 %	12⅝ — 13⅛	12⅝ — 13⅛	13	12 5/16	+ ⅛	5 5 8
752,400	Do. 4 % Deb. Stock	Stock	4 %	4 %	4 %	4 %	99½—101⅛	100 —102	101	..	+ ½	3 18 5
269,700	East & S. Afric. Tel., 4 % Mt. Db., 1 to 8,000, red. 1909	100	4 %	4 %	4 %	4 %	99 —101	99 —101	..	..	..	3 19 3
200,000‡	Do. 4 % Reg. M. Debs. (Mauritius Sub.) 1 to 8,000	25	4 %	4 %	4 %	4 %	100½—102½	100⅜—102½	..	..	..	3 18 1
181,127	Globe Telegraph and Trust	10	5⅛%	5½%	5½%	5½%	10½ — 11	10⅝ — 11	10⅝	10 11/16	..	5 14 10
181,127	Do. do. 6 % Pref.	10	6 %	6 %	6 %	6 %	13½ — 14	13⅝ — 14	..	..	..	4 5 9
150,000	Great Northern Telegraph, of Copenhagen	10	24 %	24%	20 %	20 %	27½ — 29½	28 — 30	28 15/16	..	+ ½	6 13 4
19,600‡	Halifax and Bermudas Cable, 4½ % 1st Mort. Debs., within Nos. 1 to 1,200, Red.	100	4½%	4½%	4½%	4½%	99 —101	99 —101	..	..	..	4 9 1
17,000	Indo-European Telegraph	25	13 %	13 %	13 %	13 %	56 — 59	56 — 59	56½	..	..	6 7 1
$41,380,400	Mackay Companies Common	$100	1 %	2 %	3½%	4 %	69 — 73	69 — 73	..	..	..	5 9 7
$50,000,000	Do. do. 4% Cum. Pref.	$100	4 %	4 %	4 %	4 %	69 — 73	69 — 73	..	..	..	5 9 7
884,190	Marconi's Wireless Telegraph	1	Nil	Nil	Nil	Nil	⅜ — ½	⅜ — ½	..	..	..	Nil
72,680	Monte Video Telephone Co., Ltd. Ord.	1	4 %	5 %	6 %	6 %	1 — 1⅛	1 — 1⅛	2⅛	..	..	5 6 8
86,492	Do. do. do. 5 % Pref.	1	5 %	5 %	5 %	5 %	27/32 — 29/32	27/32 — 29/32	..	..	..	5 8 1
2,225,000	National Telephone, Pref. Stock	100	6 %	6 %	6 %	6 %	106½—108½	107⅛ 109½	108⅜	107½	+1	5 9 7
3,725,000	Do. do. Def. Stock	100	5 %	5 %	5 %	6 %	119 —121	119½—121½	121½	119½	+ ½	4 18 9
15,000	Do. do. 6 % Cum. 1st. Pref.	10	6 %	6 %	6 %	6 %	10 — 12	10 — 12	..	..	..	5 0 0
15,000	Do. do. 6 % Cum. 2nd Pref.	10	6 %	6 %	6 %	6 %	10 — 12	10 — 12	..	..	..	4 3 4
250,000	Do. do. 5 % Non-cum. 3rd P., 1 to 250,000	5	5 %	5 %	5 %	5 %	5⅛ — 5⅜	5 3/16 — 5 5/16	5⅜	..	+ 1/16	4 6 11
2,000,000	Do. do. 3½ % Deb. Stock Red.	Stock	3½%	3½%	3½%	3½%	98½—100⅛	98½—100⅛	97⅝	..	..	3 7 8
1,716,593	Do. do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	102½—104½	103 —105	103½	..	+ ½	3 16 2
179,313	Oriental Telep. and Elec. 1 to 171,504, fully paid	1	6¾%	7 %	7 %	8 %	1 3/32 — 1 5/32	1 3/32 — 1 5/32	25/-	..	..	5 19 8
50,000	Do. do. do. 6 % Cum. Pref.	1	6 %	6 %	6 %	6 %	1 1/16 — 1 1/16	1 1/16 — 1 1/16	..	..	..	4 11 5
99,100	Do. do. do. 4 % Red. Deb. Stock	100	..	4 %	4 %	4 %	88 — 92	89 — 92	..	..	..	4 7 0
99,400	Pacific & European Tel., 4 % Guar. Debs., 1 to 1,000	10	4 %	4 %	4 %	4 %	97½—100½	98 —101	..	..	..	3 18 10
11,889‡	Reuter's	8	5 %	5 %	5 %	5 %	7⅞ — 8⅛	7⅞ — 8⅛	..	..	..	4 17 7
99,100	Telephone Co. of Egypt, 4½ % Deb. Red.	100	..	4½%	4½%	4½%	99 —102	99 —102	..	..	..	4 8 3
3,083	Submarine Cables Trust	Cert.	6 %	6 %	6 %	6 %	128 —131	128 —131	..	..	..	4 11 7
100,000	United River Plate Telephone	5	8 %	8 %	8 %	8 %	6⅞ — 7⅛	6⅞ — 7⅛	..	..	..	5 12 3
40,000	Do. 5 % Cum. Pref., Nos. 1 to 40,000	5	5 %	5 %	5 %	5 %	4⅜ — 4⅝	4⅜ — 4⅝	5⅛	91/10½	+ ⅛	5 5 3
30,098	W. Coast of America, 1 to 30,000 & 53,001 to 53,098	2½	Nil	Nil	2½%	2½%	1 3/16 — 1 5/16	1 3/16 — 1 5/16	23/9	..	..	4 8 11
150,000	Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel.	100	4 %	4 %	4 %	4 %	98 —101	98½—101½	..	..	+ ½	3 19 7
207,980	Western Telegraph, Ltd., Nos. 1 to 207,980	10	7 %	7 %	7 %	7 %	13½ — 14½	13½ — 14½	14	..	..	4 19 3
800,000	Do. do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	100 —102	101 —103	..	..	+ 1	3 17 8
88,321	West India and Panama Telegraph	10	Nil	Nil	Nil	Nil	1/16 — 1/8	1/16 — 1/8	11/10½	..	..	Nil
34,568	Do. do. 6 % Cum. 1st Pref.	10	6 %	5 %	8 %	6 %	8 — 8½	8 — 8½	..	..	..	7 1 2
4,669	Do. do. 6 % Cum. 2nd Pref.	10	Nil	Nil	Nil	£2 6	8½ — 9½	8½ — 9½	..	..	..	2 9 0
80,000‡	Do. do. 5 % Debs., Nos. 1 to 1,900	100	5 %	5 %	5 %	5 %	100½—102½	100½—102½	101	..	..	4 17 7

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.

330,000	Anglo-Argentine Trams, 10 % Nom. Cum. 2nd Pref., 260,008 to 580,097	5	8 %	8 %	8 %	9 %	8⅝— 5/4	8⅝— 8⅞	8⅞	8 21/32	..	5 1 5
260,007	Do. 6 % Cum. Prefs., 1 to 260,007	5	5¼%	5¼%	5¼%	5¾%	6 3/16— 6 7/16	6 3/16— 6 7/16	6 5/8	6 7/32	..	4 9 4
266,600	Do. Permanent, 6 % Deb. Stock, 1888	100	6 %	6 %	6 %	6 %	141 —146	141 —146	143	..	..	4 2 2
285,100	Auckland E. Trams, 5 % 1st Mort. Deb. Stock	100	5 %	5 %	5 %	5 %	103 —106	103 —106	..	..	..	4 14 4
880,000	Babcock & Wilcox, 1 to 880,000	1	20 %	20 %	20 %	20 %	8½— 8¾	8⅞— 9	81/-	78/9	+ 3/16	4 17 0
100,000	Do. do. 6 % Cum. Pref., 1 to 100,000	1	6 %	6 %	6 %	6 %	1 3/16— 1 5/16	1 3/16— 1 5/16	32/6	..	+ 3/16	3 13 10
40,000	British Aluminium, Ord., 1 to 40,000	5	7 %	7 %	7 %	7 %	2½ — 3	2½ — 3⅛	60/-	..	..	10 15 4
40,000	Do. do. 7 % Cum. Pref.	5	7 %	7 %	7 %	7 %	3½ — 4	3½ — 4	82/6	..	..	8 4 8
20,000	Do. do. "A" 6 % Cum. Pref.	5	6 %	6 %	6 %	6 %	4 — 4½	4 — 4½	..	..	..	6 6 4
20,000	Do. do. 4 % Funding Certs.	5	4 %	4 %	4 %	4 %	3¾— 4¼	3¾— 4¼	..	..	..	4 14 1
388,200	Do. do. 5 % 1st Mort. Deb. Stock Red.	Stock	5 %	5 %	5 %	5 %	106 —110	106 —110	..	..	..	4 10 11
800,000	Do. do. 5½ % Loch Leven Debs.	100	..	..	5½%	5½%	97 —100	97 —100	..	..	..	5 10 0
400,000	British Columbia E. Rail Def. Ord. Stock	100	6 %	6 %	6 %	8 %	123 —128	123 —128	..	..	..	6 5 0
800,000	Do. 5 % Pref. Ord. Stock	100	5 %	5 %	5 %	5 %	109 —113	109 —113	..	..	..	4 8 6
800,000	Do. 5 % Cum. Perp. Pref. Stock	100	5 %	5 %	5 %	5 %	104 —108	104 —108	..	..	..	4 12 7
333,000	Do. 4½ % 1st Mort. Debs., 1 to 6,250	40	4½%	4½%	4½%	4½%	101 —104	101 —104	102½	..	..	4 6 7
220,000	Do. 4½ % Vancouver Power Debs., 1 to 2,200	100	4½%	4½%	4½%	4½%	100 —103	100 —103	..	..	..	4 7 5
133,301	British Electric Traction	10	6 %	3 %	Nil	Nil	1 5/16 — 1 7/16	1½ — 1⅝	..	..	— 1/16	Nil
161,427	Do. do. 6 % Cum. Pref.	10	6 %	6 %	6 %	3 %	4 — 4½	3¾ — 4⅛	81/3	..	— ⅛	7 1 2
1,473,653	Do. do. 5 % Perp. Deb. Stock	Stock	5 %	5 %	5 %	5 %	95 — 98	95 — 98	..	..	..	5 2 0
528,936	Do. do. 4½ % 2nd Deb. Stock Red.	100	4½%	4½%	4½%	4½%	76 — 78	76 — 78	..	..	..	5 15 5
100,000	British Insulated and Helsby Cables	5	8 %	8 %	10 %	10 %	6½ — 6⅝	6½ — 6⅝	..	..	..	7 8 2
100,000	Do. do. 6 % Cum. Pref.	5	6 %	6 %	6 %	6 %	6 — 6⅛	6 — 6⅛	..	..	..	4 12 4
600,000	Do. do. 4½ % 1st Mort. Deb. Red.	100	4½%	4½%	4½%	4½%	103 —106	103 —106	..	..	..	4 4 11
212,000	British Thomson-Houston 4½ % 1st Mort. Debs.	100	4½%	4½%	4½%	4½%	93 — 98	93 — 98	..	..	..	4 11 10
400,000	British Westinghouse 6 % Pref., 1 to 200,000 and 275,001 to 475,000	5	Nil	Nil	Nil	Nil	⅜— ½	⅜— ½	..	..	..	Nil
1,016,353	Do. do. 4 % Mort. Deb. Stock	100	4 %	4 %	4 %	4 %	43 — 48	43 — 48	..	..	..	8 6 8
50,000	Browett, Lindley & Co., Ord.	1	Nil	Nil	Nil	Nil	3/16 — 1/4	3/16 — 1/4	..	..	..	Nil
50,000	Do. do. 6 % Cum. Pref.	1	Nil	Nil	Nil	Nil	14/6 to 15/6	14/6 to 15/6	..	..	..	Nil
105,731	Brush Electrical Engineering, Ord., 1 to 105,731	2	Nil	2½%	Nil	Nil	0 — ⅛	0 — ⅛	..	..	..	Nil
150,000	Do. do. Non-cum. 6 % Pref.	2	6 %	6 %	Nil	Nil	⅛ — ¼	⅛ — ¼	..	..	..	Nil
125,000‡	Do. do. 4½ % Perp. Deb. Stock	Stock	4½%	4½%	4½%	4½%	70 — 75	70 — 75	..	..	..	6 0
125,000‡	Do. do. 4½ % Perp. 2nd Deb. Stock	Stock	4½%	4½%	4½%	4½%	50 — 54	50 — 54	..	..	..	8 6
187,610	Calcutta Trams, 1 to 187,610	5	8 %	8 %	8 %	6 %	5¼ — 5⅝	5¼ — 6	5 15/16	..	+ ½	5 0 0
80,000	Do. 5 % Cum. Pref., Nos. 1 to 29,880	5	..	5 %	5 %	6 %	4¾ — 5¼	4¾ — 5¼	..	..	..	4 15 3
350,000	Do. 4½ % 1st Deb. Stock	100	4½%	4½%	4½%	4½%	101 —104	101 —104	..	..	..	4 6 7
85,000	Callender's Cable Construction shares	5	12½%	15 %	15 %	15 %	9¾ — 10⅜	9⅞ — 10⅜	10⅛	9⅝	..	6 19 6
40,000	Do. do. 5 % Cum. Pref.	5	5 %	5 %	5 %	5 %	5¼ — 5⅝	5 3/16 — 5⅝	5 5/16	5⅛	..	5 6 11
800,000	Do. do. 4½ % 1st Mort. Deb. Stock Red.	Stock	4½%	4½%	4½%	4½%	106 —108	106⅝—108½	107⅛	..	+ ⅛	4 2 6
491,222	Cape E Trams., 1 to 491,222	1	5 %	Nil	Nil	Nil	1/16 — 1/8	1/16 — 1/8	..	..	..	Nil
450,000	Castner-Kellner Alkali, 1 to 450,000	1	4 %	6 %	8 %	12 %	1 1/16 — 1 1/8	1 1/16 — 1 1/8	10/9	29/9	+ 1/16	7 7 8
215,045	Do. do. 4½ % 1st Mort. Deb. Stock	100	4½%	4½%	4½%	4½%	101 —104	102 —105	..	..	+1	4 5 9
1,898,610	Central London Railway, Ord. Stock	Stock	4 %	4 %	4 %	3 %	68 — 70 xd	67 — 69	68	..	—1	4 6 11
558,195	Do. do. 4 % Pref. Stock	Stock	4 %	4 %	4 %	4 %	86 — 87 xd	86 — 87	..	..	..	4 12 0
558,195	Do. do. Def. do.	Stock	4 %	4 %	4 %	2 %	51 — 54	49 — 52	51	..	—2	3 16 11
1,499,000	City and South London Railway	Stock	2¾%	1¾%	2¾%	2¾%	32 — 33	32 — 33	33	..	..	6 8 9

* Unless otherwise stated, all shares are fully paid. † A period of nine months. ‡ From Manchester Share List.

Continued on next page.

SHARE LIST OF ELECTRICAL COMPANIES.—(*Continued.*)

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.—(*Continued*)

Present Issue.	NAME.	Stock or Share.	Dividends for the last four years.				Closing Quotations Aug. 18th.	Closing Quotations Aug. 25th.	Business done week ended Aug. 25th, 1908.		Rise + or Fall —	Present Yield per cent.
		*	1904.	1905.	1906.	1907.			Highest	Lowest.		£ s. d.
85,000	Crompton & Co., Nos. 1 to 85,000	S	2½%	2½%	5 %	5 %	1⅛ — 1⅜	1⅛ — 1⅜	..	..	— 3/16	9 10 6
100,000‡	Do. 5 % 1st Mort. Reg. Debs., 1 to 900 of £100, and 901 to 11,000 of £50 Red.	..	5 %	5 %	5 %	5 %	90 — 93	90 — 93	..	..	..	5 5 11
260,000	Dick, Kerr & Co., 1 to 260,000	1	10 %	10 %	10 %	10 %	1⅝ — 1⅞	1⅝ — 1⅞	26/3	22/6	..	7 5 5
305,000	Do. do. 6 % Cum. Pref., 1 to 305,000 ..	1	6 %	6 %	6 %	6 %	1 — 1¼	1 — 1¼	22/3	..	..	4 16 0
282,580	Do. do. 4½ % Deb. Stock	100	4½%	4½%	4½%	4½%	99 —102	99 —102	..	..	..	4 8 3
60,000	Dublin United Trams. (1896), 1 to 60,000	10	6 %	6%	6 %	6¼%	12 — 13	12 — 13	..	..	..	4 18 1
59,987	Do. 6 % Pref. between 1 and 60,000	10	6 %	6 %	6 %	6 %	12½ — 13½	12½ — 13½	..	..	..	4 8 11
99,261	Edison & Swan Utd., "A" shs., £8 pd., 1 to 99,261	5	2½%	4½%	4½%	4½%	⅜ — ⅝	⅜ — ⅝	..	..	..	16 12 6
17,189	Do. "A" shares, 01—017,189 ..	5	2½%	4½%	4½%	4½%	1½ — 2¼	1½ — 2¼	..	..	..	8 6 9
319,475	Do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	76 — 79	76 — 79	..	..	..	5 1 3
72,220	Do. 5 % 2nd Deb. Stock Prov. Certs. all pd.	100	5 %	5 %	5 %	5 %	85 — 87	85 — 87	..	..	..	5 14 11
112,100	Electric Construction, 1 to 112,100	2	4 %	Nil	Nil	Nil	5/16 — 7/16	5/16 — 7/16	7/9	7/8	..	Nil
31,890	Do. do. 7 % Cum. Pref., 1 to 31,890..	2	7 %	7 %	7 %	7 %	1⅛ — 1¼	1⅛ — 1¼	..	..	..	Nil
25,000	General Electric Co. (1900), 5 % Cum. Pref. ..	10	5 %	5 %	5 %	5 %	7½ — 8	7½ — 8	..	..	..	6 5 0
200,000	Do. do 4 % Mort Deb...	Stock	4 %	4 %	4 %	4 %	84 — 87	86 — 90	..	..	+2½	4 8 11
78,000	Gt. N. & City Rail. Pref. Ord. "A" 4 %, 1 to 78,000	10	4 %	4 %	4 %	4%	½ — 1	½ — 1	..	..	..	5 0 0
96,000	Greenwood & Batley, 7 % Cum. Pref.	10	7 %	7 %	7 %	7 %	10½ — 10¾	10½ — 10¾	..	..	..	6 10 8
80,000	Do. do. 5 % Mort. Debs.	100	5 %	5 %	5 %	5 %	102 —103	102 —103	..	..	..	4 17 1
40,000	Henley's (W. T.), Telegraph Works, Ord.	5	15 %	15%	15 %	15%	10½ — 11½	10½ — 11½	..	..	..	8 18 10
40,000	Do. do. 4½ % Pref.	5	4½%	4½%	4½%	4½%	5 — 5½	5 — 5½	..	..	..	4 1 10
150,000	Do. do. 4½ % Mort. Deb. Stock	Stock	4½%	4½%	4½%	4½%	106 — 108	106½ — 108½	..	..	+ ½	4 4 6
50,000	India-Rubber, Gutta-percha & Telegraph Works.	10	5 %	10%	10 %	10 %	15½ — 16½	15½ — 16½	..	..	..	6 1 8
37,500	†Liverpool Overhead Railway, Ord.	10	1½%	Nil	Nil	1½%	1⅝ — 1 7/16	1⅝ — 1 7/16	..	..	..	3 16 10
10,000	† Do. do. Pref., fully paid ..	10	5 %	5 %	5 %	5 %	6⅛ — 6	6⅛ — 6	..	..	..	8 6 8
600,070	London United Trams. (1901), 1 to 50,007	10	6 %	8 %	8 %	8 %	6⅝ — 6⅞	6⅝ — 6⅞	..	..	..	4 8 11
299,230	Do. do. 50,008 to 100,000	10	6 %	8 %	8 %	8 %	6⅝ — 6⅞	6⅝ — 6⅞	..	..	..	4 8 11
125,000	Do. do. 5 % Cum. Pref., 1 to 125,000	10	5 %	5 %	5 %	5 %	6¾ — 7¼	5¾ — 6⅞	..	..	—⅜	7 18 10
1,231,000	Do. do. 4 % 1st Mort. Deb. Stock ..	100	4 %	4 %	4 %	4 %	79 — 84	76 — 81	..	..	—3	4 18 9
5,732,062	Metropolitan Consolidated	100	8 %	2½%	1 %	1½%	35½ — 36½ xd	35 — 36	36½	35⅝	..	1 7 5
2,640,914	Do. Surplus Lands	100	2½%	2½%	2½%	2½%	65 — 67 xd	65 — 67	66	65½	..	4 2 1
3,235,000	Do. District	100	Nil	Nil	Nil	Nil	11 — 12	10⅞ — 11⅞	..	..	— ⅛	Nil
314,016	Metropolitan Electric Trams., Defd...	1	Nil	Nil	Nil	Nil	5/16 — 7/16	5/16 — 7/16	..	..	..	Nil
600,000	Do. do. 5 % Cum. Pref. ..	1	5 %	5 %	5 %	5 %	5/16 — 7/16	5/16 — 7/16	..	..	..	6 3 1
850,000	Do. do. 4½ % Deb. Stock Red.	100	4½%	4½%	4½%	4½%	93 — 96	93 — 96	94½	..	..	4 13 9
345,500	Potteries E. Trc.	1	5 %	4 %	4 %	4 %	⅛ — ¼	⅛ — ¼	..	..	..	8 0 0
345,500	Do. 5 % Cum. Pref.	1	5 %	5 %	5 %	5 %	⅛ — ¼	⅛ — ¼	..	..	..	6 18 4
345,000	Do. 4½ % Deb. Stock	100	4½%	4½%	4½%	4½%	93 — 96	93 — 96	..	..	..	4 13 9
37,350	Telegraph Construction and Maintenance	12	15 %	15 %	15 %	17½%	31½ — 33½	31½ — 33½	..	..	..	6 5 5
150,000‡	Do. 4 % Deb. Bds., 1 to 1,500 Red., 1909	100	4 %	4 %	4 %	4 %	100 —102	100 —102	..	..	..	3 18 5
3,599,300	Undergd. E. R., Lon., 5 % Profit Shar. S. Nts. ..	..	5 %	5 %	5 %	5 %	39 — 43	39 — 43	..	..	..	11 12 6
66,666	Willans & Robinson, 1 to 80,000 & 80,001 to 116,666	1	Nil	Nil	Nil	10 %	⅜ — 1½	⅜ — 1½	..	..	..	8 0 0
66,666	Do. 5 % C.P., 80,001 to 80,000 & 126,001 to 141,666	5	Nil	Nil	..	6 %	2⅜ — 3	2⅜ — 3	..	..	..	10 0 0
46,404	Do. 4 % 1st Mort. Deb. Stock	100	4 %	4 %	4 %	4 %	72 — 76	72 — 76	..	..	..	5 5 3

ELECTRICITY SUPPLY COMPANIES.

15,000	Bromley (Kent) E.L. & P., 1 to 15,000	5	5⅓%	5⅓%	5⅓%	5⅓%	4½ — 5	4½ — 5	..	..	..	5 10 0
70,000	Do. do. 4½ % 1st. deb. stock ..	100	4½%	4½%	4½%	4½%	94 — 97	94 — 97	..	..	..	4 12 9
80,131	Brompton & Kens. Elec. Lt. Sup., Ord., 1 to 20,000	5	10 %	10 %	10%	10 %	6¾ — 7⅜ xd	6¾ — 7⅜	..	..	..	6 9 0
9,869	Do. do. 7 % Cum. Pref.	5	7 %	7 %	7 %	7 %	6¾ — 7⅛ xd	6¾ — 7⅛	..	..	..	4 13 4
836,876	Central Electric Supply 4 % Guar. Deb. Stock ..	100	4 %	4 %	4 %	4 %	99 — 102	99 —102	..	..	..	3 18 5
80,000	Charing Cross and Strand Electricity Supply ..	5	8 %	5 %	5 %	5 %	3⅞ — 4	3⅞ — 4	..	..	..	6 5 0
80,000	Do. do. 4½ % Cum. Pref.	5	4½%	4½%	4½%	4½%	4 — 4¼	4 — 4¼	..	..	..	5 0 0
80,000	Do. "City Undertaking" 4½ % Cum. Prf.	5	4½%	4½%	4½%	4½%	3¾ — 4	3¾ — 4	72/6	..	..	5 12 6
445,736	Do. do. 4 % Deb. Stock Red. ..	100	4 %	4 %	4 %	4 %	95 — 98	96 — 99	95½	..	+ 1	4 0 10
49,436	Chelsea Electricity Supply, Ord.	5	6 %	6 %	4½%	4½%	3 — 3½	3 — 3½	..	..	..	6 8 7
175,000‡	Do. do. 4½ % Deb. Stock Red. ..	Stock	4½%	4½%	4½%	4½%	100 —103	100 —103	66/3	..	..	4 7 5
70,595	City of London Elec. Lighting, Ord. 40,001—110,595	10	6 %	6 %	6 %	6 %	9⅛ — 10⅛	9⅛ — 10⅛	10	9⅞	..	5 17 1
40,000	Do. 6 % Cum. Pref., 1 to 40,000	10	6 %	6 %	6 %	6 %	11⅛ — 12⅛	11⅛ — 12⅛	12⅛	12 3/16	+ ⅛	4 14 1
400,000‡	Do. 5 % Db. Stk., Scrip. (iss. at 115) all pd.	..	5 %	5 %	5 %	5 %	122 —125	122 —125	123	..	..	4 0 0
800,000	Do. 4½ % 2nd. Db. Stk., Prov. Crts., all pd.	100	4½%	4½%	4½%	4½%	101 —104	101 —104	..	..	..	4 6 7
40,000	County of Durham Electrical Power, Ord.	5	£3 7 0	4 %	4 %	2 %	2⅜ — 3	2⅜ — 3	..	..	..	3 6 8
50,000	Do. do. do. 5 % Pref. ..	5	5 %	5 %	5 %	5 %	3⅜ — 4½	3⅜ — 4½	..	..	..	5 17 8
40,000	County of London Electric Lighting, Ord. 1—40,000	10	4½%	5 %	5 %	5 %	7⅜ — 8⅝	7⅜ — 8⅝	..	..	..	5 17 8
40,000	Do. do. 6 % Pref., 40,001—60,000	10	6 %	6 %	6 %	6 %	10⅛ — 10⅝	10⅛ — 10⅝	10⅝	..	+ ⅛	5 10 4
400,000‡	Do. do. 4½ % Deb. Stock ..	..	4½%	4½%	4½%	4½%	106 —109	107 —110	..	..	+ 1	4 1 10
400,000	Do. do. 4½ % 2nd. Deb. Stock.	Stock	4½%	4½%	4½%	4½%	98 —101	99 —102	..	..	+ 1	4 8 3
80,000	Edmundson's Electric Corporation, Ord. Shares ..	5	7 %	4 %	Nil	Nil	⅛ — ⅜	⅛ — ⅜	..	..	..	Nil
80,000	Do. do. 6 % Cum. Pref.	5	6 %	6 %	3 %	Nil	⅛ — 1	⅛ — 1	..	..	..	Nil
433,000	Do. do. 4½ % 1st Mort. Deb. Stk.	100	4½%	4½%	4½%	4½%	58 — 65	59 — 66	..	..	+ 1	6 16 4
10,000	Folkestone, 1 to 10,000	5	5½%	5½%	5½%	5½%	4⅜ — 5⅛	4⅜ — 5⅛	..	..	..	5 4 9
10,000	Do. 5 % Cum. Pref., 1 to 10,000	5	..	5 %	5 %	5 %	5 — 5⅛	5 — 5⅛	..	..	..	4 10 0
90,000	Do. 4½ % 1st Deb. Stock	100	4½%	4½%	4½%	4½%	97 —100	97 — 100	..	..	..	4 10 11
15,000	Hove, 1 to 15,000	5	8½%	9 %	9 %	8½%	6 — 6¼	6 — 6¼	..	..	..	6 10 9
21,000	Kensington and Knightsbridge Electric Ord. ..	5	12 %	10 %	10 %	10 %	7⅞ — 8¼ xd	7⅞ — 8⅛	..	..	..	5 14 8
90,000	Do. do. do. 4 % Deben. Stk.	Stock	4 %	4 %	4 %	4 %	94 — 97	94 — 97	..	..	..	4 2 6
10,000	London Electric Supply Corporation, Limited, Ord.	3	3 %	4 %	4 %	2½%	⅞ — 1⅛	⅞ — 1⅛	..	..	..	5 8 1
70,000	Do. do. do 6 % Pref. ..	5	6 %	6 %	6 %	6 %	4½ — 5	4½ — 5	92/6	90/-	..	6 0 0
74,395	Do. do. 4 % 1st Mort. Deb. Stk. Red. ..	Stock	4 %	4 %	4 %	4½%	89 — 92	89 — 92	89½	..	..	4 17 10
200,000	Metropolitan Electric Supply, 1 to 100,000	5	10 %	10 %	8 %	6½%	4½ — 5	4½ — 5	92/6	90/-	..	6 3 11
76,121	Do. 4½ % Cum. Pref. 1—71,106	5	4½%	4½%	4½%	4½%	4½ — 5	4⅝ — 4⅞	..	..	— ⅛	4 12 4
230,000‡	Do. 4½ % 1st Mort. Deben. Stock ..	..	4½%	4½%	4½%	4½%	105 —109	105 —109	..	..	..	4 2 7
250,000‡	Do. 3½ % Mort. Deben. Stock Redem.	Stock	3½%	3½%	3½%	3½%	84 — 89	84 — 89	..	..	..	3 18 8
250,000	Midland Electric Corporation, 4½ % 1st Mort. Deb.	100	4½%	4½%	4½%	4½%	94 — 97	94 — 97	..	..	..	4 12 9
87,500	Newcastle-on-Tyne, 1 to 87,500.	5	8 %	8 %	8 %	8 %	5½ — 5⅝	5½ — 5⅝	..	..	— ⅛	7 2 3
87,500	Do. 5 % Pref., 1 to 87,500	5	5 %	5 %	5 %	5 %	5½ — 5⅞	5½ — 5⅞	..	..	..	4 6 11
10,863	Notting Hill Electric Lighting	10	7 %	7½%	7½%	7½%	12 — 13	11½ — 12½	..	..	— ½	5 17 8
20,000	Oxford, 1 to 96 and 407 to 20,810	5	7 %	7 %	7 %	7 %	5⅝ — 6⅛ xd	5⅝ — 6⅛	..	..	..	5 14 3
50,000	Do. 4 % Deb. Stock	100	4 %	4 %	4 %	4 %	95 — 99	95 — 98	..	..	..	4 0 10
40,000	St. James' and Pall Mall Electric Light, Ord.	5	14½%	12½%	10 %	10 %	7 — 8	7 — 8	..	..	..	6 5 0
20,000	Do. 7 % Pref. 20,001 to 40,000	5	7 %	7 %	7 %	7 %	6¾ — 7¼	6¾ — 7¼	..	..	..	4 16 7
150,000‡	Do. do. 3½ % Deb. Stock Red. ..	100	3½%	3 %	3½%	3½%	86 — 90	86 — 90	88½	..	..	3 17 9
12,000	Smithfield Markets Electric Supply, Ord. ..	5	4 %	4 %	Nil	Nil	⅛ — ¼	⅛ — ¼	..	..	..	Nil
50,000	Do. do. do. 4 % Deb. Stock	Stock	4 %	4 %	4 %	4 %	68 — 72	68 — 72	..	..	..	5 11 1
65,000	South London Electricity Supply, Ord.	5	4 %	4 %	3 %	4 %	2⅜ — 2⅝	2⅜ — 2⅝	..	..	..	6 19 2
120,000	South Met. Elec. Lt. & Power, Ord.	1	Nil	2½%	2½%	2½%	⅜ — ½	⅜ — ½	..	..	..	4 0 0
117,988	Do. do. 7 % Pref.	1	7 %	7 %	7 %	7 %	1 — 1⅛	1 — 1⅛	20/-	..	..	6 12 0
200,000	Do. do. 4½ % 1st Deb. Stk.	100	4½%	4½%	4½%	4½%	100 —103	100 —103	..	..	..	4 7 5
80,000	Urban Electric Supply, Ord.	5	5 %	5 %	5 %	5 %	⅞ — 1⅛	⅞ — 1	..	..	— ⅛	20 0 0
50,000	Do. do. 5 % Cum. Pref.	5	5 %	5 %	5 %	5 %	1⅝ — 2⅛	1⅝ — 2⅛	..	..	..	10 10 6
200,000	Do. do. 4½ % 1st Mort. Db. Stk. Red.	100	4½%	4½%	4½%	4½%	82 — 86	82 — 86	..	..	..	5 5 11
110,000	Westminster Electric Supply, Ord.	5	14 %	18 %	12 %	10 %	7¼ — 8¼	7⅛ — 8¼	..	..	..	5 17 8
81,279	Do. do. 4½ % Cum. Pref. ..	5	5 %	5 %	5 %	4½%	5 — 5⅛	5 — 5⅛	..	..	..	4 1 10
	(Original 5 %—Red. to 4½ % from 31st Dec., 1905)											

* Unless otherwise stated, all shares are fully paid. † Quotations on Liverpool Stock Exchange. ‡ Interim Dividend.

Bank rate of Discount 2½ per cent., May 28th, 1908.

EXPORTS AND IMPORTS OF ELECTRICAL GOODS DURING JULY, 1908.

THE July returns of electrical business indicate a considerable revival of trade as compared with the previous month.

Indeed, the value of the export business, £211,087, is quite a record so far as our statistics are concerned, the highest value previously recorded being £208,385 in March last.

The imports, which were valued at £164,162, show an even greater appreciation, the June total being £122,665; and even the re-exports, which have shown a downward tendency for some time past, have more than doubled their value.

As regards exports, the high total is largely contributed to by the electrical machinery section, which amounted to over £100,000 in value; but electrical cable, goods, lamps, &c., are also above the normal. The import of electrical machinery, valued at £64,000, compares with £35,600 in June, and the next item of importance is the lamp imports, amounting to some £25,600 in value. As usual in this section, Germany obtained the lion's share of the business.

While our Indian and colonial possessions are well represented as purchasers of British material, China and Japan were in July amongst our best customers.

Registered Exports of British and Irish Electrical Goods from the United Kingdom.*

Country receiving exports and importing.	Electrical goods and appliances.	Electrical cable.	Electric lighting fittings and accessories.	Electric lamps.	Electric meters and instruments.	Electric machinery.	Batteries and accumulators.	Carbons.	Telegraph and telephone material and electric bells.	Electrically-driven machinery.	Tramway apparatus and materials.	Total.
	£	£	£	£	£	£	£	£	£	£	£	£
Russia, Sweden, Norway and Denmark ...	219	332	70	107	191	1,308	120	11	108	...	...	2,466
Germany	305	7,535	...	50	692	930	19	3	53	52	...	9,639
Netherlands	361	567	46	4	39	604	5	...	14	...	...	1,640
Belgium	89	718	42	85	52	1,526	3	...	448	...	...	2,963
France	131	20	10	916	28	1,514	37	...	82	...	...	2,738
Portugal, Madeira, Portuguese Africa & India	37	693	152	193	51	4,315	3	25	50	...	...	5,519
Spain and Canary Isles	35	166	38	14	22	1,122	13	...	13	...	...	1,423
Italy and Austria-Hungary	144	129	18	103	286	5,245	59	90	...	...	...	6,074
Greece, Roumania, Turkey and Persia ...	...	44	62	...	...	100	9	...	...	3	...	218
Channel Isles, Gibraltar and Malta	132	339	2	...	9	219	3	6	12	15	...	737
U.S.A. and Philippines	110	...	...	39	...	367	8	5	3	...	...	532
Canada and Newfoundland	439	3,674	92	216	15	3,187	99	43	...	...	...	7,765
British West Indies and British Guiana ...	20	...	20	29	...	58	8	...	...	...	...	135
Mexico, Colombia and Venezuela	...	21	198	15	...	172	...	6	...	30	...	442
Peru and Uruguay	309	18	259	64	...	191	...	24	46	...	...	911
Chile	132	1,388	132	216	99	800	248	...	91	...	...	3,106
Brazil	316	1,748	51	179	33	3,041	...	15	16	34	...	5,433
Argentine	1,420	2,921	400	1,186	570	7,125	454	338	...	...	...	14,414
Egypt and Tunis	66	450	2	5	177	187	68	...	46	21	...	1,022
British West Africa	30	99	...	39	65	160	56	...	8	...	...	457
Cape of Good Hope	358	128	284	99	127	559	96	13	167	...	...	1,831
Natal	345	2,045	248	341	318	5,784	46	91	...	...	...	9,318
Brit. East Africa, Mauritius and Aden ...	...	162	118	37	...	116	...	...	79	...	...	512
China, Siam and Korea...	803	1,378	942	555	552	21,322	9	30	...	...	...	25,591
Japan	206	6,022	442	26	894	10,414	2,900	45	...	...	...	20,949
Dutch Indies	99	...	...	...	...	61	...	...	...	...	...	160
India...	1,980	5,850	3,068	1,141	1,392	11,104	2,345	282	189	4,637	...	31,988
Burmah and Assam	227	899	30	57	10	1,228	5	...	...	150	...	2,606
Ceylon	168	92	62	9	12	166	11	...	1	45	...	566
Straits Settlements and Fed. Malay States ...	186	1,386	163	224	11	3,317	17	40	449	167	...	5,960
Hong Kong and Wei-Hai-Wei...	162	980	217	210	3	1,846	29	54	26	...	...	3,527
West Australia	278	608	92	221	...	67	27	...	...	...	...	1,293
South Australia	25	15	44	48	7	437	...	8	...	...	...	584
Victoria	554	8,488	202	571	329	1,803	128	5	74	17	...	12,171
New South Wales	1,944	4,888	653	2,932	1,413	6,693	165	...	438	25	...	19,151
Queensland	232	755	...	4	6	283	7	...	37	...	...	1,324
Tasmania	94	...	2	50	3	508	270	...	78	...	...	1,005
New Zealand	408	997	485	202	560	2,252	17	...	39	57	...	5,017
Total, £	12,364	55,555	8,646	10,187	7,966	100131	7,284	1,134	2,567	5,253	...	211,087

Registered Imports into the United Kingdom of Electrical Goods from all Countries.

	£	£	£	£	£	£	£	£	£	£	£	£
Russia, Norway, Sweden and Denmark ...	...	178	...	71	...	2,566	474	85	2,591	...	...	5,965
Germany	2,099	11,883	9	12,221	155	40,398	494	2,311	2,036	250	...	71,856
Holland	119	2,017	442	9,448	1,542	2,000	441	5,933	495	...	...	22,437
Belgium	998	5,961	750	1,559	86	6,571	103	746	7,391	450	...	24,615
France	148	4,219	100	1,971	425	70	3,266	2,301	2,149	5	...	14,654
United States	4,533	1,084	1,073	442	...	12,247	254	59	300	3,902	...	23,894
Canada	...	...	50	...	...	180	...	...	...	...	...	230
Total, £	7,897	25,342	2,424	25,712	2,208	64,032	5,032	11,435	14,962	4,607	...	163,651

Additional Imports: Portugal, batteries, £17; Italy, electrical machinery, £30; Argentine, telephone apparatus, £400; and New South Wales, electrical machinery, £64.

Registered Re-Exports of Foreign and Colonial Electrical Goods from the United Kingdom.

	£	£	£	£	£	£	£	£	£	£	£	£
Various countries, mainly as above	3,578	3,775	...	2,934	...	4,637	41	877	2,057	...	...	...

TOTAL EXPORTS: £211,087. TOTAL RE-EXPORTS: £17,899. TOTAL IMPORTS: £164,162.

NOTE.—The amounts appearing under the several headings are classified according to the Customs returns. The first and third columns contain many amounts relating to "goods" otherwise unclassified, the latter, doubtless, consisting of similar materials to those appearing in adjacent columns.

* This section does not include telegraph cables and apparatus

SOME NOTES ON STEEL CONSTRUCTIONAL WORK FOR CENTRAL STATIONS.

By J. H. S.

These notes are not intended as a short-cut text-book, but are recorded in the hope that a few points, chiefly gathered from practice, may be of value. The Engineering Standards Committee have, in their various publications, issued from time to time, simplified the constructional engineer's duties and relieved him of many intricate problems. The fullest advantage should be taken of these publications by draughtsmen and engineers responsible for central station design.

All joists, channels, tees, angles, &c., are standardised and their weights, sizes, areas, moments of inertia, section modulus, &c., published in handy form. In every case, except for the smallest sizes, for framework of doors, &c., these standards can be worked to with a saving in time and money, through the simplification of calculations and drawing office work. A further economy is also obtained due to all the sizes being stock sections, which can be bought either direct from the rolling mills or through a local agent or girder merchant.

For all ordinary connections the drillings, cleats, rivet diameters, &c., have been standardised, and can be found in most makers' catalogues, these should not be departed from, except in abnormal circumstances. The drillings, &c., given in Tables A and B, are suitable for use with almost every type of riveter, or for hand work.

TABLE A.

TABLE B.

Width of flange.	C.
Inch.	Inch.
3	1½
4	2¼
4½	2⅜
5	2¾
6	3½
7	4
7½	4½

Width of flange.	G.	Diameter of bolt, &c.
Inch.	Inch.	Inch.
1	9/16	3/8
1¼	11/16	½
1½	13/16	½
1¾	15/16	⅝
2	1⅛	⅝
2¼	1¼	¾
2½	1⅜	¾
2¾	1½	¾
3	1⅝	⅞
3½	2	1

Rest variable.

Table A gives holes in joist and tee flanges. Table B gives holes in angle and channel flanges. These dimensions should be strictly adhered to, and a copy of the tables given to each draughtsman.

The majority of steel for constructional use is manufactured by the basic open hearth or Bessemer process. This steel will have a tensile stress of from 28 to 32 tons per square inch; and an elongation of 20 per cent. in a length of 8 in. with 40 per cent reduction of area at point of fracture.

Allowing a working stress in the outer fibres of 7·15 tons per square inch, which corresponds to a factor of safety of 4; a useful formula for cantilevers or beams (uniformly loaded) is

$$\text{Moment of resistance or section modulus} = \frac{\text{Load in lb.} \times \text{span in inches}}{\text{constant} \times 16{,}000}.$$

The load in lb. equals the total load to be supported by that beam, the span is the clear distance between supports in inches. The "constant" is the familiar figure 2, 4 or 8 found in the formula—

$$\frac{W\ L}{2,\ 4 \text{ or } 8},$$

according to whether the structure is acting as a cantilever or beam, with concentrated or distributed load. In the case of a continuous beam such as a purlin, being evenly loaded in each bay, the formula is $\frac{W\ L}{12}$.

The figure 16,000 represents 7·15 tons per square inch fibre stress, and is a useful all-round figure for calculations.

Assuming that a concrete floor has to be designed for an engine-room, the maximum loading being 300 lb. per square foot, with the span 12 ft. and the joists spaced with 3 ft. centres. The total load on each joist is 10,800 lb.

$$\frac{10{,}800 \times 12 \times 12}{8 \times 16{,}000} = 12{\cdot}1 \left\{ \begin{matrix} \text{the required section} \\ \text{modulus.} \end{matrix} \right.$$

On reference to the tables, it will be seen that one of two sections will answer the purpose. An 8 in. × 4 in. or a 6 in. × 5 in., the first named being 18 lb. per foot run, and the last 25 lb. per foot run. From this it will be seen that the apparently smaller beam is the heavier, and that the utmost economy is practised by carefully referring to the tables, and comparing the weights per foot run with the section modulus and treating the size simply as an answer to an equation. A 9 in. × 4 in. × 21 lb. and a 15 in. × 5 in. × 42 lb. are the most economical sections, and should always be used in place of an 8 in. × 5 in. or 12 in. × 6 in., except where the depth of floor or head room is restricted. While on this question, it must be remembered that the width of flange should not be less than $\frac{1}{30}$th of the span, in order to prevent the joist from being crippled by buckling. This does not apply to a joist embedded in a concrete floor, as in this case the concrete will take up all side thrust.

The span of a joist should not exceed 20 times the depth; if it does, undue deflection will occur, which will crack the floor, &c. Special attention must be paid to joists supporting built-up tanks, as any deflection will cause the joints to open and leakage will take place. On any maker's list of loadings for joists of different spans, a diagonal stepped line is drawn, and all spans outside this line will cause undue deflection.

On accepting delivery of rolled steel joists, angles, &c., a careful inspection is necessary in order to avoid using foreign material, it being inadvisable to use foreign rolled steel, quite apart from patriotic motives. Most foreign sections are based on the *metric* measurement, and it will be found that very few dimensions are in even numbers of inches, but have an odd $\frac{3}{32}$ in. or $\frac{5}{16}$ in.; these odd figures are great labour makers, especially in the drawing office. An excellent article appeared in the technical Press a short time ago on even dimensions. Another more serious item is that to make these foreign joists come up to the published weights of standard beams, material is added to the web. This extra material in the web is of no possible use, and not only does it add useless weight to the structure but the joist is not up to the required strength.

Authorities disagree on the question of painting steel work, which is intended to be buried in concrete. The apparently correct practice is to scrape and clean off all rust and paint, and to give the steel work a coat of cement and water, allowing the wash to harden before concreting.

In any building where there is any possibility of vibration or temperature variation, it is advisable to dispense altogether with brick arches and substitute rolled steel joists as lintels. If the lintel is in a thick wall, two joists can be placed side by side, either separate or with a plate riveted on the top, also with one on the bottom if required. The

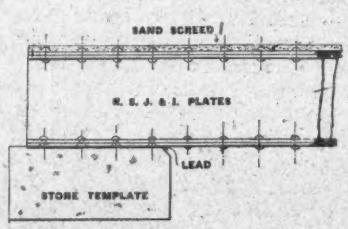


Fig. 1.

pitch of rivets for the connection of a plate to a rolled steel joist, should be such that the plate cannot spring away from the flange of the joist and is usually 16 times the thickness of plate. The rivets on the bearing area should be countersunk (see fig. 1) with a cement and sand screed on the top for bedding down the bricks. All joists for lintels should be some multiple of the height of a course of brickwork; if this is done a lot of cutting or an ugly course, brick on edge, will be avoided. The safe loadings for various materials to act as templets are given in Table C. In most structures

a sheet of lead, Willesden paper or felt is placed under each joist resting on stone or brickwork, in order to take up any inequalities in the two rigid materials, and thus assist in distributing the load. It is advisable to slightly bevel the templets, as shown in fig. 1, in order to prevent the edge from being chipped off.

When stanchions are designed, special care should be given to the section with regard to the ease of making connections. A simple combination of one or two joists with plates, is preferable to a complicated combination of different sections, latticed, although the latter may be the lightest, and apparently the more efficient. When the cost of special connections and the uncertainty of tapped holes and set screws are considered, the heavier section will be the cheaper. In examining the riveting of plates to steel joists, it is often noticed, when the eye is cast along a line of rivets, that apparently the heads are off the centre of the hole, leading one to the conclusion that the hole in the plate does not cover the hole in the joist. This is almost an impossibility if the work is carried out in a modern shop using multiple spindle drills and holing both plate and joist in one operation. In reality, the decentralisation of the rivet head is due to the top of the flange of the joist being at an angle of 8° to the plate and causing the rivet head to be slightly heavier on one side than on the other.

All holes in steel work should be drilled, or, if punched, should be reamed out to remove the damaged area caused by the violent action of punching.

When calculating stanchions, it is not necessary to add the maximum weight of every floor together. According to the use to which each floor is put, a certain percentage of the possible live load must be taken and added from floor to floor. If one floor has a heavy dead load such as accumulators, then the whole of the dead load should be taken, plus a certain weight for a possible live or temporary load. It is only necessary to assume the length of a stanchion as that distance between floors or other places where it is securely stayed. If in any structure there is a long length not tied together, it will often pay to put in an efficient tie, and thus cut down the section required.

In designing a roof truss it is always advisable to use two angles, back to back as in fig. 2, in place of a tee bar. The two angles greatly facilitate the connection of various members by means of the joint plates, these joint plates

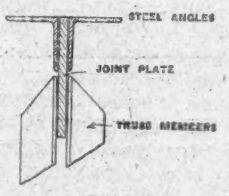


Fig. 2.

being placed between the angles, so that, back to back, the angles are from ½ in. to ¾ in. apart. The fixing of lantern lights and ventilators is also simplified, and the slight extra weight added is more than repaid by the superior job when complete. The distance apart of stanchions is often settled by the pitch of the roof truss principals. If purlins of channel iron section are used and the design of the truss carefully gone into, with wind bracing considered, the number of principals and stanchions can often be reduced by 25 per cent., with a far more convenient building at a considerably less cost. When hoisting trusses from the ground, it is advisable to have them securely braced by scaffold poles lashed diagonally across them, reaching from end to end. These light structures may be considerably strained by rough handling, and every precaution should be taken to prevent the members being strained and bent.

A useful memorandum for initial calculations is, that the average loading of slates, or glass, including battens or glazing bars, with wind pressure, is 50 lb. per sq. ft. Snow need not be calculated, as the wind pressure is never at a maximum when snow is laying.

When these designs are being prepared it is as well to thoroughly consider the rain-water pipe system. In England 1 sq. in. per 200 sq. ft. of roof is a good average figure to work to. All rain water should be led into the feed tank, as in many cases where the feed water is of a hard nature, the slightly acid rain water will help to neutralize the effects of the hard water.

A most important factor in lightening and cheapening building construction is the introduction into the concrete floors, walls, &c., of steel to take up the tension. It is well known that concrete, while extremely strong in compression, is unreliable in tension; this is overcome by inserting rods, wire or expanded metal below the neutral axis of a slab

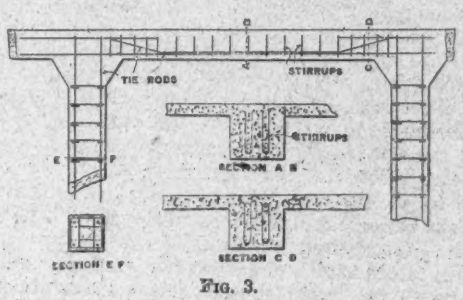


Fig. 3.

of concrete. The strength of a slab thus treated is considerably increased, or for a uniform loading the thickness of the concrete can be decreased, the result being that smaller sizes of joists, stanchions, &c., can be used with a proportionately less weight on the foundations. With the use of expanded metal suitably selected to the thickness of floor, and carefully embedded in the concrete, at least 50 per cent. of the bulk of concrete can be saved. The sectional area of the expanded steel compared to the sectional area of the concrete is given by the makers as ½ per cent. This figure has been verified in tests made by engineers, and can safely be worked to. This material is of great assistance in forming concrete coal bunkers, tanks, &c.

Another widely used system of ferro or reinforced concrete construction is the "Hennebique." This is not only used to reinforce concrete slabs between rolled steel joists, but is intended primarily to supersede the use or steel joists altogether, and is used in forming stanchions of pillars, joists, &c. In this method rods are introduced into the concrete of approximately the same shape as the bending moment diagram, being at the top of the concrete, near and at the supports or reactions, and slanting downwards towards the centre to take up the tension stress (see fig. 3).

Stirrups, or U-shaped pieces of flat iron, are introduced every few inches (see fig. 3, sections AB, CD,) to resist the shear along the neutral axis. Any column or combination can be formed by rods and flat iron distance pieces, the rods being threaded through the iron (sec. EF, fig. 3). The weight of a structure of this description must be considerably more than that of an ordinary steel building, with reinforced ferro-concrete floors, laid between rolled steel joists. The strength of a chain being that of the weakest link, the strength of a concreate building must be that of the joints in the concrete walls, &c. In some cases, especially in a complicated structure, a horizontal joint, or even worse, a vertical one, may stand for a week or more exposed to the action of a drying wind or fierce sun. A joint of this description, even if carefully cleaned and wetted, can never equal the strength of a mass continuously deposited, and a large proportion of the strain must be borne by the tie rods.

No ferro-concrete of any description is admitted into any calculations for constructional work, coming under the jurisdiction of the London Building Act, and all floors, bunkers, &c., have to be constructed of full thickness whether reinforced or not. All floors for central stations must be calculated for a loading of 3 cwt. per square ft.

Table D gives the maximum stresses allowable for work coming under the above Act. Under this ruling iron chimneys are only allowed as temporary structures, and a license has to be obtained and renewed every half year. These chimneys are not considered self-supporting, and must be stayed by guy ropes, straining screws, &c.

TABLE C.

Granite, safe stress	20 to 30	tons per sq. ft.
Sandstone, safe stress	12 to 15	" "
Blue bricks, safe stress	10	" "
Ordinary red bricks, safe stress	5	" "
Brick set in cement and capped with stone, safe stress	6	" "
Stock brick set in cement, safe stress ...	7	" "
Concrete, safe stress	7	" "

TABLE D.

Mild steel in tension	7	tons per sq. in.
" shear	5	" "
" bearing	10	" "

CONTRACTS WITH LOCAL AUTHORITIES.

[FROM A LEGAL CONTRIBUTOR.]

ENGINEERING firms who are tempted to execute work for local authorities must needs exercise a certain amount of caution before they sign the contract. Where there is an individual employer to be dealt with no great difficulty need arise under the head of "extras," "penalties for delay," &c.; but where there is a municipal body, or an Urban District Council, in the case, it is another matter.

If they act harshly, and exact their full rights at law, their justification is, "We must protect the ratepayers." The contractor, therefore, who is making a tender for a particular job should take all necessary legal steps to protect himself.

A case which was reported in the *Times* of July 18th (Bell *v.* Bridlington Corporation), affords a striking example of the difficulties which may beset the contractor. It appears that a firm of contractors entered into negotiations with the Bridlington Corporation for the laying of a drain which was to run across the foreshore out to sea. The plaintiffs' tender to do the work for £700 was accepted by the Corporation, under whose engineer the work was to be carried out. He was to have authority to order payment for extra work. The plaintiffs alleged that owing to alterations made in the line on which the pipes were to be laid, they were entitled to disregard the lump sum contract, and charge for the work on a new basis, namely, according to its value, which was estimated at £2,000. The defendants resisted this in law, because no new contract was sealed, and on the facts because they said that any alterations which were ordered tended rather to simplify the work than to make it more difficult. Mr. Muir Mackenzie, the Official Referee, who tried the case, decided that there was no such alteration of the work ordered by the Corporation, or done by the contractor, as entitled him to claim that there was a new contract. He also held that assuming such altered work was ordered by the engineer, the Corporation were not liable to pay for it on the grounds (*a*) that Sec. 174 of the Public Health Act, 1875, prevents a contractor from maintaining any claim on such a contract, it not being under seal; and (*b*) that the borough engineer had no authority to order such a deviation from the work. He also held that the amount already paid in respect of extras was sufficient, and in the event, he gave judgment for the Corporation.

The interesting point in the case arises in connection with the seal. It is provided by Sec. 174 of the Public Health Act, 1875, that with respect to contracts made by an urban authority under that Act, every such contract, whereof the value or amount exceeds £50, shall be in writing, and sealed with the common seal of such authority.

Does this mean that where a contract is entered into between a contractor and a borough council every variation must be reduced into writing and duly agreed to under seal? It appears that it is not necessary to press the decision as far as this; for it has been held that where a local authority enters into a sealed contract for the execution of sewerage works, with power to the engineer to vary, alter, and enlarge or diminish any of them, all variations and alterations coming within the terms of the power conferred on the engineer can be validly made without being under the common seal of the urban authority. (Williams *v.* Barmouth U.D.C., 77 L.T. 383.)

It is, however, quite clear upon the authorities that where work is done for a local authority, even when the authority retains and accepts the benefit thereof, the person who has carried it out can pursue no remedy unless he has insisted on the contract being sealed. A case tried in 1883 (Young *v.* Mayor of Leamington, 1883, 8 A.C. 517) affords a striking illustration. A contractor named Powis undertook the erection of certain works for supplying Leamington with water. He failed to complete his contract, which was put an end to. The engineer of the Corporation was then authorised by resolution (and not under seal) to employ another contractor to complete the work. A firm of Young and Co. were so employed. They did the work, and were paid from time to time on certificates; but ultimately, after the Corporation had taken over the works, there was still a sum of £6,000 or £7,000 outstanding. The Corporation resisted payment of this on various grounds, the absence of a contract under seal being their objection in point of law.

The House of Lords held that this objection was valid. Some of their Lordships expressed the view that it was a hardship upon the plaintiffs, but Lord Herschell was emphatic in the other direction. He said: "The Legislature has made provisions for the protection of ratepayers, shareholders and others, who must act through the agency of a representative body, by requiring the observance of certain solemnities and formalities which involve deliberation and reflection. That is the importance of the seal. It is idle to say there is no magic in a wafer. It continually happens that carelessness and indifference on the one side, and the greed of gain on the other, cause a disregard of these safeguards, and improvident engagements are entered into. . . The decision may be hard in this case on the plaintiffs who may not have known the law. They and others must be taught it, which can only be done by its enforcement."

The last few words of this judgment point the moral of the case before Mr. Muir Mackenzie. We do not know whether there were any circumstances of exceptional hardship connected with the work at Bridlington, as the sum paid by way of extras is not stated in the report. But it is obvious that everyone who enters into a contract with an Urban District Council must take steps to prevent a technical defence to what may be a just claim.

NOTES ON ELECTRICITY SUPPLY—FOR THE YOUNG.

BY A. J. ABRAHAM, A.M.I.E.E.

ELECTRICITY is a wonderful thing, and is composed of two agents (not commission agents), namely, "Volts" and "Amperes." In every electricity works there is a switchboard. All over this switchboard are fixed little round boxes marked "A" and "V." The amperes are compressed into boxes marked "A," and the volts into those marked "V." There are machines called dynamos which, when driven round by an engine, compress the two agents of electricity into their respective boxes. These dynamos are composed of two parts—(1) The armature; (2) The field. The amperes come from the armature and the volts from the field.

Now it must be explained that volts and amperes are deadly enemies, and are for ever trying to get at one another. If they do succeed the result is astounding and most terrifying. There is a terrible row, blinding flashes and a strong smell of sulphur. The volts are, therefore, sent out by one path to one side of a lamp, and the amperes by another path to the other side of the lamp. The things they say to one another (using the filament of the lamp like a telephone) across the lamp causes this to turn white hot, and give out the light which we know so well.

Near the switchboard will be seen a man smoking a pipe and drinking tea. This is the switchboard attendant who

looks after the switchboard and keeps the volts and amperes in order. Occasionally he will move round the board tapping the boxes which I have described. If one sounds hollow he knows that it is getting empty. In this case he generally whistles to the man who looks after the engines to either make an engine go faster or to put on another engine. Sometimes, however, he will use very strong language down a tube to a place called the boiler house.

If by any chance the volts and amperes wander from their respective paths and meet at any place the switchboard attendant gets very excited, the volts all crowd into the ampere boxes, which sometimes burst, the engines groan, and the light becomes dull. Sometimes more engines have to be put on. When order is restored the switchboard attendant rings up another man on the telephone. This other man is the mains superintendent, and his duty is to see that the volts and amperes do not meet under the loads, and when they do meet he has to repair the place where they have been fighting. The road surveyor and the mains superintendent are very great friends—something like volts and amperes. Every morning the road surveyor sends round to see what roads the mains super. has pulled up doing the night, and asks why the "metal has all been mixed up with the muck." This is what is called "fault-finding." When the mains engineer goes forth in the night, he is said to be "looking for trouble," which he generally gets in the morning when the surveyor knows what he has done to the road, which was repaired and rolled the week before.

It must not be thought that the mains super. and three switchboard attendants are the only officers who look after the electricity supply works. There are others, and I will describe them and their duties as shortly as possible :—

1. The station super. is a Scotchman from Dundee, and a marine engineer. He is named McTodd, not because that is his right name, but because during his time at sea he seems, curiously enough, to have done most of the things which the famous McTodd of "Captain Kettle" fame did. Sometimes he is called James Washington McTodd. I do not know why, because his name is not James Washington, but Donald McDonald. The station super. spends a great deal of his time finding out what the switchboard attendants know about electricity, puts it all down in a notebook, learns it off by heart, and then tells the chief engineer.

2. The chief clerk is just an ordinary clerk, who says very hard things to the storekeeper and meter reader. He was the first man in this station who attempted to explain the maximum demand system to a consumer. He now gets the second clerk to do this work.

3. The second clerk spends a lot of his time reading about the maximum demand system, with a slide rule in one hand, and a revolver in the other. He is looking for another job.

4. The switchboard attendants I have already fully described. They say they are underpaid and sweated, which is quite true. They are going to form a union or an association so that they can strike, which is very silly, because switchboard attendants are as numerous as the hairs of our head. Signs have, indeed, already begun to appear in your advertisement columns that switchboard attendants will soon have to pay so much a week for their jobs.

5. The mains super. wears leggings, and is a very wonderful and skilled man. How he looks for trouble and knows what is going on under the ground, I will not attempt to describe (as it is too complicated for you to understand), but he does know. He talks to McTodd about loop tests and locating faults, and McTodd puts it down in his book when he is alone and learns it. The mains super. is a very good judge of character, and his description of the road surveyor is terse and to the point.

6. The chief assistant looks after all the other officers and their work. He also interviews travellers, which has given him a very careworn look and spoilt his faith in mankind. On his heart will be found engraved "Salooline oil, 5 per cent. ; calorimeter, 10 per cent. ; Jay's mechanical stoker, 10 per cent., &c., = total saving brought about in works costs = 150 per cent.

7. The chief engineer need not be an engineer at all. In our station the present chief started by being a relation of the Mayor. In others he is a retired (*sic*) ironmonger, a draughtsman, a non-professional engineer, &c. He must, however, pretend to be a great engineer. It is necessary for him to be a good talker before his committee and to be able to use long words which they do not understand. A good non-professional chief should know how to use the brains of his subordinates. Before his subordinates, he must, however, be a silent man, or he will give himself away. Our particular chief, as I stated before, was a relation of the Mayor, but when the Mayor got pushed out of the Council, he saved his bacon by marrying the daughter of his chairman (who is a pork butcher). He calls the Councillors "Sir," and shows what *he* has done on the mains (the mains super. will tell you all about it). He points out what he has done in the station in front of McTodd, who uses very bad language about it afterwards. Our first chief engineer was a real engineer, but when our present chief took his job, the Council were soon shown what a fool the first man was, and how he had ruined the station. The first thing he did was to extend a black slate switchboard by white marble panels, and when his committee saw how different his work was from the old bad chief's work, they sang his praises from the housetops (because they had appointed him).

8. The office boy is underpaid, his pay being the same as that received by the switchboard attendants. I am the office boy, so modesty forbids that I should say any more. I trust that these notes will be of some interest to those who have not had the opportunity of studying the internal workings of an electricity supply undertaking. I warn the Editor that if he does not publish this I will send it to the *Daily Mail*, along with the description of the latest electrical gun which, I understand, will send a shot weighing 5 tons across to New York when fired by four large Leclanché cells. The gun makes no noise or smell, which is a great improvement on a motor-'bus.

TANGLED TOPICS.

By "INNOCENS."

Readers of the Electrical Review will have noticed in its "Correspondence" columns that the millenium is now upon us. The lion is about to lie down with the lamb, and the show is just a'goin' to begin, so kindly walk up and become a son of Jove or some other apocryphal person. In other words, if I have not misread the purport of certain mysterious foreshadowings, a species of debating society is about to be formed which will earnestly, soulfully, and we may hope, prayerfully, consider whether it be not possible for brother to rush into the arms of brother, previously casting away a transport of enthusiasm the tomahawk of competition which has hitherto been used in effecting a forceful separation of the scalp of profits from the brow of electrical science. This aphorism is, I know, sanguinarily awful.

Far be it from me to belittle the value of such an enterprise. One great good point in its favour is that one of its pioneers, Mr. Borlase Matthews, will, I am sure, bring to it the same earnestness and sincere enthusiasm with which he recently championed the cause of electric publicity. But surely, for a headlong tilt against the vices of things as they are, this attempt beats the sermon of an East-End curate. If it succeeds, the electrical industry will be regenerated to a percentage that a Raworth tramway system could not reach. If it fails, its promoters will feel like the little girl who awoke in the middle of a night succeeding a heavy supper, having dreamt that she had swallowed herself, and being anxious to ascertain the truth or otherwise of the impression. In other words, to be Yankee, they have "bit off more than they can chew."

But, assuming that the debating society does meet, and survives the stage of complimentary speech-making and mutual abrasion of the spinal column, let me put before them an item which should be fairly near the top of the agenda. This might be labelled, "What's in a Name?" And the reason that I introduce this subject of debate is that there are amongst us wholesale manufacturers, supply

houses and local contractors. Now, which is which and which is t'other?

If I am not mistaken, certain firms of magnitude, probably finding that owing to foreign intrusion their market for big dynamos and similar plant is going, have decided to open shop down a back street in the provincial town and sell small supplies, from a one-and-thripenny glow lamp to a pennyworth of fuse wire. They will even go one better and, sticking a coil of wire on their backs and a pair of pliers in their trouser's pocket, go out and wire the suburban villa at competitive rates. They may be likened unto the man who, finding he is unable to get his railway fare to the grouse-moors of Scotland, borrows a blunderbuss from a farm lad and goes out shooting rooks.

There is, of course, nothing in the constitution to stop them doing this, but it is not exactly according to the standard rules of cricket, and moreover, it is exceedingly rough on the middleman and the local contractor. And it all goes to show that we are not in the profession of electrical engineering for the honour and glory of it, but simply for the worship of the shy god Mammon. Is it to be hoped that the debating society or Bond of Brotherhood, or whatever it is to be called, will induce a recognition of the delimitation of frontier, and allow the contractor and retailer to work in peace and comfort side by side with the manufacturer? If so, the consummation is devoutly to be desired.

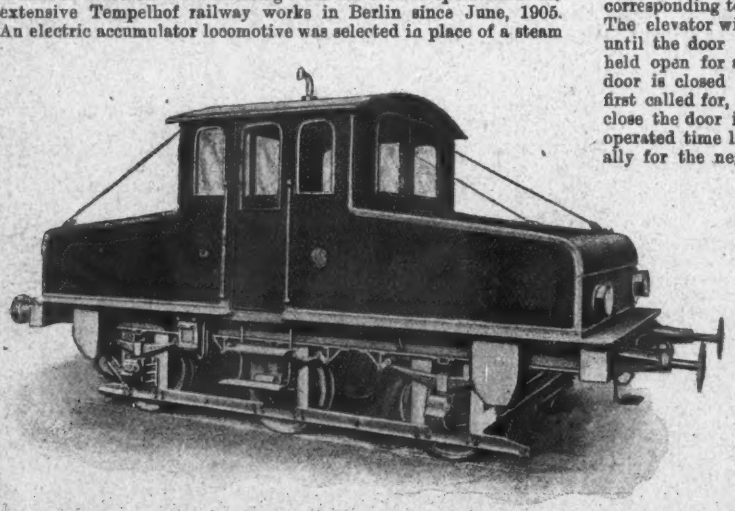
Whoever is responsible for this modern move of large manufacturers should remember that they cannot be all things to all men. It takes more than one performer to make a band. The action of firms who endeavour to make a profit out of everything, without discrimination as to the variety of business they are tackling, reminds one of the sad history of Mary as expressed in the rhyme :—

Mary had jam,
Mary had jelly,
Mary had pains in her poor little—
(Don't be mistaken!
Don't be misled!
Mary had pains in her poor little head.)

In other words, the richly deserved fate of those pushful firms who are removing the landmarks of their neighbours' fields will be, a bad headache.

AN ACCUMULATOR-DRIVEN SHUNTING LOCOMOTIVE.

A useful locomotive for shunting work has been in operation at the extensive Tempelhof railway works in Berlin since June, 1905. An electric accumulator locomotive was selected in place of a steam loco or an electric loco with overhead supply, because it is always ready for use, and can be economically operated in spite of long intervals of idleness; it also requires little attention and no overhead construction is necessary. The difficulty in charging the cells and maintaining them in good condition, met with in accumulator tramway traction, does not exist in this case, as the intervals of idleness are ample for the purpose.



An Accumulator Shunting Locomotive.

The great weight of the cells is rather an advantage in enabling the loco to exert the high draw-bar pull often required in shunting work. The specification required the locomotive to be able to do 1,500 ton-miles (including its own weight) in 53 distinct journeys with various stated loads on a single charge.

The locomotive is a standard gauge, one with three axles, of which the two outer ones are driving axles. The greatest width is 9 ft. 8 in.; length over buffers, 25 ft. 6 in.; height over rails, 11 ft. 4 in.; weight complete, 24·3 tons. The electrical equipment consists of 160 cells with a capacity of 235 ampere-hours on a four-hour discharge.

There are two series motors, geared to the wheels with single reduction spur gear having a ratio of 4·54 : 1. At 300 volts the two motors give about 40 h.p. together. A series-parallel controller, arranged for short-circuit emergency braking, is used.

The charging is carried out from the public supply at 440 volts, the regulation being accomplished efficiently by inserting a motor in series with the supply and absorbing the energy of the motor in a dynamo directly coupled to it which feeds back into the supply mains.

The machines are arranged to permit of charging at the high rate of 150 amperes when necessary. No stand-by charging plant is required, as in case of breakdown a simple water resistance can be improvised for reducing the voltage.—E. T. Z., *June 25th*, 1908.

AUTOMATIC ELEVATORS.

It has become a well accepted idea that in comparison with its ease, certainty and safety in operation, the initial cost of an electric lift is a secondary consideration, and to this cause may be attributed the increasing popularity of the automatically operated push-button lift, which, by placing the working of the lift under the control of the passenger himself, avoids the necessity of continual expenditure on a lift attendant. There arise cases, however, where automatically controlled lifts prove of doubtful value, the difficulty to which we allude increasing with the increasing size of the lift and the consequently larger number of passengers that it can carry at a time. When such an elevator is at rest on a main floor, passengers can open the door themselves, enter, and have to close the door for themselves before pressing the button and ascending; the elevator can then ascend and stop at the floor first called for. The passenger who pressed the corresponding button has to open the door for himself, and the passengers left inside have to close the door after him; after this they have to find out for themselves who wishes to go to the next higher floor, and they have again to press a button corresponding to that floor. The same cycle of operations goes on until the last passenger has got to his floor, and the elevator stops there until someone presses the button for its return to the ground floor. All this necessitates a certain loss of time and possible confusion, and a patent recently taken out by Messrs. Naujoks, Naujoks & Goppert, of California, is designed to overcome this drawback by introducing what may be considered the limit to automatic control in lift operation.

The door, when the elevator is at rest on the ground floor, is open, and as each passenger enters he may depress the button corresponding to the floor he wishes to arrive at, indiscriminately. The elevator will close the door automatically, and will not start until the door is absolutely shut. If necessary, the door can be held open for any length of time, as it closes gently. When the door is closed and locked, the elevator will ascend to the floor first called for, open the door automatically, let the passenger out, close the door itself after a certain time (regulated by a motor-operated time limit device in the basement) and start automatically for the next floor, when the cycle of opening the door and allowing the passengers to depart and starting on its upward trip is again automatically performed.

It will stop at any floor and take passengers higher when on its upward trip, and lower when on its downward trip, in response to the pressure on a button on that floor by a passenger outside. When it has taken its last passenger to his destination it will automatically close the door, go to the highest floor in the building, open the door wide until the time limit has expired, close the door and go to the basement, taking any passengers down on its way, but refusing to take any up until its journey is complete. The cage always slackens speed gradually and gently when it arrives at the floor at which it has to stop; there is a switch provided to cut out any floor, and if required the elevator may be returned to the ground floor when the last passenger has been discharged, instead of going to the top as previously described.

It is impossible in the space at our disposal to describe the patent in detail, but its main points are the provision of a current-dividing strip extending to the top and bottom of the elevator shaft, and carried on spring-controlled rollers, so that the insulating space between the two strips can move up and down with the cage, the slack being wound in at the top or bottom.

By means of a direction changer operated on the cage by a riction grip on the main cable, all the electro-magnets of the floors below the elevator are placed in parallel on a circuit when the elevator is moving downwards, while those of the floor above the elevator are on the broken circuit, and conversely when the direction of the elevator is reversed. Thus, on pushing any push-button on the floor of the elevator shaft below the elevator or any button in the elevator corresponding to that floor, the electro-magnet operating the motor circuit can be energised if the car is travelling downwards, while pressing the button on a floor above that at which the elevator is situated at the moment, has no effect. The action of the magnet is to complete the motor circuit through a current reverser, whose position depends upon the position of the car with relation to it, by means of a tappet arrangement; this regulates the direction in which the current passes through the motor, and, therefore, determines whether the cage will be raised or lowered on the closing of the motor circuit.

Provision is made so that the motor circuit cannot be closed unless every door opening into the elevator shaft is also closed, by providing a break in the circuit at each door in series with the main motor circuit, all these breaks having to be bridged before current is passed. By means of rolling mechanical contacts the insertion of a series of high-resistance wires into the electric circuit simultaneously with the gradual opening of the doors as the elevator arrives at the required floor, ensures the gradual bringing to rest of the car in the proper position, and a time arrangement—dependent on an air or oil plunger operating the grip of the circuit-changing device on the car—ensures a sufficient time being allowed before contact is made, preparatory to another trip. If a longer time is necessary, the door can be held back by a light pressure of the hand. In order to prevent too sudden rushes of the current when the circuit is closed, a motor current check is inserted in the main circuit, whereby resistance is gradually withdrawn from the motor circuit by means of a small auxiliary motor operating the starting switch.

Such, in brief, are the provisions of this new patent, which seem to indicate very clearly the lines on which the further application of automatic control to electric elevators should be carried out. A complete perusal of the specification can only lead one to an appreciation of the continuous application of the inventors in solving this most difficult problem, and it will be interesting to see whether, in actual practice, this apparently complete solution of the problem presents any of those working defects which so often nullify the value of the most ingenious patents.

THE JUNIOR INSTITUTION OF ENGINEERS.

Summer Meeting in France.

That eminent French artillerist, Monsieur Gustave Canet, being President of the Institution this year, it was but natural that the Council should have sought to arrange for the summer meeting of 1908 to take place in his country, with a visit to the famous works of Messrs. Schneider & Co., at Le Creusot, where he was for a number of years director of the artillery section, as one of the principal attractions.

The detailed programme, which was ultimately issued, bore evidence throughout of the invaluable assistance the President had rendered in its preparation. He was unfortunately prevented by illness from joining in the welcome which was everywhere accorded the members, but with that consideration so characteristic of him he had deputed his two sons, Messieurs Paul and Albert, to take his place in that respect, and they performed their duties in happiest mood and with the utmost fidelity and grace.

The majority of the party left London on Saturday, June 27th, for Paris, the proceedings opening on the following Monday morning with a visit to the renowned Conservatoire National des Arts et Metiers in the Rue St. Martin, by the special permission of the Minister of Commerce and Industry, the buildings being closed to the public. The collection of models and specimens catalogued numbers over 14,000, and embraces the whole range of the applied sciences. In the physics rooms were noticed various electro-magnetic apparatus relating to the study and investigation of lighting by electricity, measurements of currents, induction, thermo-electric phenomena, &c. The testing department with its mammoth 300-ton Buckton machine also contained many features of exceptional interest, nor must mention of the classic musical automata, by Houdin, which were set going for the visitors' benefit, be forgotten.

The next visit was to the automobile works of Messrs. de Dion Bouton, at Puteaux, on the Quai National. Here the Marquis de Dion and M. Bouton received the members, and during the tour of the works, which cover an area of about 10 acres, the electrical engineers included in the party noticed a great deal that appealed particularly to them. The factory motive power—electricity—is derived from dynamos which are driven by seven gas engines aggregating 350 H.P., gas being supplied from a producer plant. Current can also be obtained, if required, from the mains of the Ouest Lumière Co., who have a generating station close at hand. The different processes in the manufacture of sparking plugs were shown, and also the experimental mechanical and chemical laboratory containing a special department of micrography for researches into the composition of new alloys, tempering ovens with water and oil cooling arrangements, and instruments for temperature determination were likewise on view.

In the evening a reception was given by the President, Monsieur E. Reumaux, and Council, of the Institution of Civil Engineers of France, of which body Monsieur G. Canet is a past president, at their well-appointed home in the Rue Blanche. Of the cordiality of the greeting extended to the young engineers, there could be no question, and Mr. F. R. Durham, on their behalf, warmly reciprocated the sentiments which the French president employed in the address of welcome he delivered to them on assembling in the lecture theatre.

On the following day the members became the guests of Messrs. Samuel Cutler & Sons, who had a steamer reserved for taking them down the river to Nanterre, to inspect the works of the Compagnie l'Union des Gaz, and the gasholder of 80,000 cb. ft. capacity, which Messrs. Cutler are erecting there, the excursion also affording the opportunity of seeing under very pleasant conditions some of the scenic beauties of the Seine. Monsieur Charpentier, engineer at the works, and Mr. Samuel Cutler, jun., past chairman of the Institution, acted as guides.

The visit, which it was generally agreed created the deepest impression, was that to the extensive works of Messrs. Schneider and Co., at Le Creusot, situated at a distance of about eight hours by rail from Paris, *viâ* Dijon. Monsieur Eugene Schneider had specially invited the members over, and most perfect and hospitable in the extreme were the arrangements made for their interest and pleasure. Notable processes, &c., of importance in the rolling mill and armour plate departments, also in the ordnance section, locomotive and boiler divisions, steel works and blast furnace departments, were shown. Two main shops at the south end of the works are devoted to electrical construction purposes, one of them being used for the fitting of small and medium size machines, and for the erection of large dynamos. A portion of this shop is also utilised for the stamping, cutting out and putting together of dynamo sheets for which processes punches, lathes, and hydraulic presses are provided, the largest being capable of dealing with drum armatures up to 10 ft. in diameter. In the other main building small and medium sized dynamos are built, and the fitting of accessory devices and winding operations are carried on. Messrs. Schneider have also, at Champagne sur Seine, a large works for the production of electric plant, a view of which was obtained from the train *en route* to Le Creusot.

The members arrived back in Paris on Friday morning, and in the afternoon enjoyed the rarely accorded privilege of being shown over a sugar refinery, Monsieur Peytel, the managing director, having kindly given permission for a visit to the manufactory of the Société des Raffinerie d'Sucreie Say, on the Boulevard de la Gare; while in the evening the Institution's summer dinner was successfully held in the richly decorated circular hall of the Grand Hotel, the chairman, Mr. Durham, presiding. The guests included representatives of the Institution of Civil Engineers of France, and other friends of the English society. On the following evening the President and Madame Canet gave a dinner at the well-known Pre Catelan Restaurant, in the Bois de Boulogne, in honour of the Institution.

The first visit of the second week of the meeting was arranged through Count de la Vaulx, Hon. Member of the Institution and Vice-President of the Aero Club de France. Armed with passes signed by Monsieur Ernest Archdeacon, the members were admitted into the closely guarded military drill ground at Issy les Moulineaux, where M. H. Farman made his sensational flight last January, and which has now an additional claim to fame by reason of his achievement in the evening of the day of the Institution's visit in winning the Armengaud prize of £400 offered to the first aviator who should remain in the air for a period of 15 minutes. The members were permittted to examine the aeroplane with which this feat was accomplished, and also the one used by M. Bleriot in a flight of over three minutes' duration, which they saw him carry out in the afternoon. It was evident that further progress in the art of aerial navigation must largely depend on increasing the power and efficiency of the motor—petrol driven. Perhaps Mr. Edison may surmount this difficulty by providing the means for propulsion by electric power.

After leaving MM. Bleriot and Farman, the party were conducted to the works of the Société pour la Fabrication des Munitions d'Artillerie, where cartridge cases of the larger sizes were shown in course of manufacture, and a visit to the electric generating station of the Chemin de fer Ouest (Usine Electrique de Moulineaux), containing nine Westinghouse generators of 800 KW. capacity each, concluded the programme for the day.

On the following morning Monsieur Eiffel, the engineer and constructor of the tower bearing his name, met the members at the base of the structure, and, after showing them the machinery by which the lifts are operated, accompanied them to his laboratory at the summit, where, with the aid of drawings and photographs, he explained the principles of the design and the mode of erection of the tower. In the afternoon, during a visit to the works at the crossing of the River Seine by line No. 4 from the Porte de Clignancourt to the Porte d'Orleans, the members were enabled to study the methods adopted in the construction of the municipal Metropolitan Electric Railway, the arteries of which are spreading under the city in all directions. On one part of the section of the line visited, it is proposed to have recourse to the freezing process, in which the water-logged subsoil is frozen, and the tunnel cut out from the solidified ground.

Current for the railway is supplied from the power house at St. Denis, belonging to the Société d'Electricité de Paris, which was visited on the following afternoon. It was completed towards the end of the year 1906, and is divided into three groups of buildings

—coal stores, boiler houses and electric generating plant houses. Therelare 12 sets of machinery, each capable of giving out 6,000 KW., or on an overload up to 7,300 KW. The generators are of Parsons' steam turbine type, as manufactured by Messrs. Brown, Boveri and Co. The boilers, 24 in number, are of the Babcock & Wilcox type, with automatic feed on the chain-grate system. The current supplied consists of three-phase current at 10,250 volts pressure and 25 periods per second; two-phase at 12,300 volts and 42 periods; and continuous at 230 and 550 volts.

On Thursday afternoon, July 9th, the members left Paris for Le Havre, visiting during the following morning, by permission of the Chamber of Commerce, the Docks and celebrated coffee depôts of the port. In the latter attention was directed to an ingenious electric elevator for transporting the sacks of coffee to the upper floors of the warehouses. The works of the Société des Forges et Chantiers de la Mediterranée, in which are constructed all types of engines for naval, military and merchant service, were then seen, the afternoon was occupied on the important harbour extension works and by an inspection of the electric lighthouse, which is built on an eminence commanding a fine view of the Seine estuary. Early on Saturday morning a commencement was made on the return journey to England, a few hours being spent at Rouen for a glimpse of some of its ancient architectural adornments. Soon the members were speeding towards Dieppe and thence homewards, carrying with them happiest recollections of their eventful sojourn amongst their French colleagues.

NEW PATENTS APPLIED FOR, 1908.

Compiled expressly for this journal by W. P. Thompson & Co., Electrical Patent Agents, 322, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

16,755. "Sound-proof telephone box and the like." W. H. Colwill and J. H. Horswell. August 10th.

16,766. "Improvements in or relating to electro-magnetic clutches." Siemens Bros. Dynamo Works, Ltd. (Siemens-Schuckertwerke G.m.b.H., Germany.) August 10th. (Complete.)

16,772. "New or improved electrotherapeutic apparatus." J. Purthner, F. Zimmerl, and J. Böck. August 10th.

16,774. "Improvements in and relating to fuses with double action." J. Harle. (Application for Patent of Addition to No. 1820/08.) August 10th. (Complete.)

16,775. "Improved pedestal or socket for poles carrying electric conductors." H. Hagi. (Date applied for under Sec. 91 of the Act, June 12th, 1908, being date of application in Switzerland.) August 10th. (Complete.)

16,788. "Improvements in telephonic microphones." V. Tardieu. August 10th.

16,791. "Improvements in and relating to electrical typewriter operating attachment for message transmission." G. A. Mayrand. August 10th. (Complete.)

16,797. "Improvements relating to electric arc lamps." T. J. Rensing. August 10th. (Complete.)

16,819. "Improvements in and relating to electrical vibrators." J. Jerome. August 10th. (Complete.)

16,836. "Improvement in electrolysis of liquids." A. A. Govan. August 11th.

16,848. "Improvements in or relating to magneto machines for use in connection with the ignition systems of internal combustion engines." R. F. Hall. (Date applied for under Rule 18, July 20th, 1908. An invention comprised in application No. 15,289, dated July 20th, 1908.) August 11th.

16,849. "Improvements in or relating to safety spark-gap devices for use in connection with the ignition systems of internal combustion engines." R. F. Hall. (Date applied for under Rule 13, July 20th, 1908. An invention comprised in application No. 15,289, dated July 20th, 1908.) August 11th.

16,852. "Improvements in sparking plugs for internal combustion engines." R. F. Hall. August 11th. (Complete.)

16,863. "Improvements in electric or like conduit jointing." T. G. Hann. August 11th.

16,865. "Electrical contacts." A. E. Woodhouse. August 11th.

16,876. "Compass to be read at a distance." G. Berlinger. August 11th.

16,900. "Improvements in or relating to magneto-electric machines." M. B. Tavoux, L. Chauchy, and T. Fraysse. (Date applied for under Sec. 91 of the Act, August 13th, 1907, being date of application in France.) August 11th. (Complete.)

16,910. "Improvements in and relating to prepayment electric meters." E Schattner and R. Amberton. (Date applied for under Rule 13, March 17th, 1908. An invention comprised in application No. 23,450, dated October 23rd, 1907.) August 11th. (Complete.)

16,911. "Improvements in and relating to commutators." C. A. Parsons and G. L. Parsons. August 11th.

16,942. "Improvements in telegraphic instruments." P. B. W. Kershaw. August 12th.

16,947. "Improvements in primary batteries." E. E. Rouse. August 12th.

16,953. "Electro-mechanical motor." D. Suchostawer. August 12th.

16,986. "Improvements relating to direct-current electric motors." Société Anonyme Westinghouse and R. Baun. (Date applied for under Sec. 91 of the Act, August 14th, 1907, being date of application in France.) August 12th. (Complete.)

16,997. "Improvements in and relating to the control of dynamo-electric machines." The British Thomson-Houston Co., Ltd., and F. W. Carter. August 12th.

17,001. "Improved method of generating electrical energy from waste heat of petrol engines and the like specially adaptable to motor vehicles." P. L. R. Fraser. August 13th.

17,033. "Improvements in circuit closers for automobiles." A. J. Cleveland (T. A. Backe, United States.) August 13th. (Complete.)

17,045. "Improvements in or relating to means for carrying and jointing electric tram wires." J. Crompton and J. Jones. August 13th.

17,047. "Improvements relating to retransmitting and reinforcing telephone currents." J. E. Kingsbury (Western Electric Co., United States.) (Application for Patent of Addition to No. 11,606/05.) August 13th.

17,048. "Improvements in telephone current retransmitting and re-inforcing apparatus." J. E. Kingsbury. (Western Electric Co., United States.) (Application for Patent of Addition to No. 11,606/05.) August 13th.

17,079. "Electrical wire overhead suspender." C. A. Brickman and A. H. Brickman. August 14th.

17,112. "Improvements in electrically-operated apparatus for controlling the movements of points or switches on tramways or railways." E. M. Monro and H. I. Rogers. August 14th.

17,113. "New or improved apparatus for washing detinned material or the like after or before electrolysis." (The London Electron Works Co., Ltd., and E. Kardos.) August 14th. (Complete.)

17,114. "New or improved electrically-insulated track and trolley." The London Electron Works Co., Ltd., and E. Kardos. August 14th. (Complete.)

17,115. "New or improved vehicle or case for conveying scrap tin or the like, for electrolysis." The London Electron Works Co., Ltd., and A. de Back. August 14th. (Complete.)

17,127. "Improvements in electric switches, pushes and the like." J. G. Childs and T. S. Hill. August 14th.

17,137. "Improvements relating to regulating the speed of continuous-current electric motors." D. Dupont and Harle & Co. August 14th. (Complete.)

17,140. "Improvements in carbons for flame arc lamps." S. Paterson and C. F. Tubbs. August 14th.

17,142. "Improvements in electric switches." H. Snowdon. August 14th.

17,143. "Improvements in electric telegraphs." E. Tyer and J. R. Dobson. August 14th.

17,159. "Improvements in or relating to electric ignition devices." A. J. Postans. August 14th.

17,161. "Improved means for indicating and recording current leakage in electric circuits or motors." Ashington Coal Co., Ltd., and T. McKie. August 14th.

17,167. "Improved plug connection for use in paralleling dynamo-electric machines." M. H. Tate. August 15th.

17,170. "Improvements in electric fuses." W. White. August 15th.

17,174. "Electrically-operated power hammer." U. Horsfall, J. Crowther and E. O. Coulthard. August 15th.

17,205. "Improvements in and relating to telephone apparatus." C. F. Bradburn. August 15th. (Complete.)

17,206. "Improvements in or relating to telephone apparatus." C. F. Bradburn. August 15th. (Complete.)

17,209. "Improvements in telephone exchange systems and apparatus therefor." J. E. Kingsbury. (Western Electric Co., United States.) August 15th.

17,210. "Improvements in devices for making and breaking electric circuits." H. Pierson and N. R. Schultz. August 15th.

17,221. "Improvements in or relating to electricity meters." G. C. Fricker and W. M. Mordey. August 15th.

17,223. "Improvements in electrical apparatus for gassing threads." G. H. Gin. (Application for Patent of Addition to No. 4,550/07.) August 15th. (Complete.)

17,227. "Improvements in or relating to electric apparatus for giving warning as to the use of currents exceeding a predetermined limit." Nalder Bros. and Thompson, Ltd., H. W. Handcock and A. H. Dykes. August 15th.

17,230. "New or improved electric appliance for stallions." R. Haddan. (J. P. Sanborn, United States.) August 15th. (Complete.)

PUBLISHED SPECIFICATIONS.

Copies of any of these Specifications may be obtained of Messrs. W. P. Thompson & Co., 322, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1907.

Multiphase Electric Induction Motors. H. A. Mavor and Mavor & Coulson, Ltd. 8,851. April 16th.

Production and Detection of Electric Oscillations. W. P. Thompson. (Ges. für Drahtlose Telegraphie, Germany.) 14,451. June 22nd.

Electro-Pneumatic Percussive Tools. H. W. Lake. (Ingersoll Rand Co., United States.) 16,327. July 16th.

Appliances for Regulating or Controlling and Measuring Electric Currents. R. Lenner. 16,485. July 18th.

Frames for Supporting Electric Conductors in the Open. T. Buchholz. 16,577. July 19th.

Protective Devices for Electric Distribution Systems. British Thomson-Houston Co., Ltd., E. B. Wedmore and W. P. Hamlyn. 16,615. July 19th.

Electric Arc Lamps Especially Applicable for Signalling Purposes and as Searchlights. G. Forbes. 16,719. July 22nd.

Electro-Chemical Deposition of Metals or for Making Metallic Articles by Electro-Chemical Deposition and Apparatus Therefor. H. C. Harrison. 16,735. July 22nd.

Means for Automatically Operating Gas or other Valves or Electric Switches at Predetermined Times. A. Hare. 16,862. July 23rd.

Portable Electrically-Driven Machine for Grinding, Sawing, Milling and the like. F. Marshall, F. Crookes and G. Robson. 17,015. July 25th.

Electric Arc Lamps. E. R. Grote and M. V. Ely, trading as Foster & Co. 17,059. July 25th.

Holders for Electric Incandescent Lamps. R. T. Preston and H. E. Theobald. 17,346. July 29th.

Current-Collecting Devices for Electrically-Propelled Locomotives and Vehicles. K. von Kando. 18,924. August 22nd.

Switch Mechanism for Electrical Signalling and like Systems. Allgemeine Elektricitäts Ges. 19,784. September 4th. (Date applied for under International Convention, September 5th, 1906.)

1908.

Sparking Plugs for Internal-Combustion Engines and the like. E. Eisemann. 7,107. March 31st.

Certain Kinds of Electric Heating Apparatus. Veritys, Ltd., and H. S. Smith. 8,471. April 16th.

Sparking Plug. G. Blum. 8,769. April 23rd. (Date applied for under International Convention, June 11th, 1907.)

Multiple Tariff Electricity Meters. H. Aron. 9,289. April 29th.

Electrical Induction Clutches. A. P. Steckel and F. du P. Thomson. 11,134. May 22nd.

Electrically-Propelled Motor Road Vehicles. A. G. Bloxam. (Siemens Schuckertwerke Ges.) 2,495. February 4th.

Appliances for Use with Telephone Transmitters for Preventing the Overhearing of Telephone Conversations. E. F. Hutton. 2,871. February 8th.

Radio-Telephony. G. Seibt. 3,583. February 17th. (Date applied for under International Convention, March 28th, 1907.)

Electric Switches. E. C. R. Marks. (Electrical Manufacturing Co., United States.) 3,760. February 20th.

Manufacture of Mantle Rings, Burner Nozzles, Deflectors, Resistances and Insulators, or other like Incombustible Articles, Used in Connection with Gas and Electric Fittings. A. A. Lines. 3,947. February 21st.

Method of Joining Metallic Bodies by means of an Electric Current Chiefly Designed for Use in Bonding Rails. G. Harrison. (Electric Railway Improvement Co., United States.) 5,015. March 5th.